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Vol. XIII No. 5

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UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1953

LITHOPRINTED IN THE UNITED STATES OF AMERICA BY
CUSHING - MALLOY, INC., ANN ARBOR, MICHIGAN, 1953

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AGRICULTURE, GENERAL

A COMPARATIVE STUDY OF SCLEROTIUM ROLFSII SACC. AND SCLEROTIUM DELPHINII WELCH.

(Publication No. 5545)

James Albert Lyle, Ph.D.
University of Minnesota, 1953

Diversity in species of fungi is a common phenomenon which occurs almost universally among those species which have been thoroughly investigated. This diversity has been attributed to different causes, the more important of which include hybridization with subsequent segregation, adaptation, mutation, genotypic variability, phenotypic variability, and nuclear phases.

Numerous differences have been observed and reported in Sclerotium rolfsii Sacc. and Sclerotium delphinii Welch. in their morphology, physiology, and ecology, and in the biotypes within each fungus group, particularly within S. rolfsii. Consequently there has been much confusion regarding the relationship between the two named species and the obvious diversity within each.

The results presented in this dissertation lead to two principal conclusions: Sclerotium rolfsii comprises many biotypes that differ in many characters, and Sclerotium delphinii should not be considered as a separate species because the differences between biotypes within the two named species are as great or greater than those between the two "species" groups. On the basis of priority the name S. rolfsii must be retained. The inclusion of what has previously been considered as S. delphinii does not require an explansion of the specific limits of S. rolfsii.

Sclerotium rolfsii must be considered as a species comprising an indefinite number of biotypes, because all of the 51 single-basidiospore isolates studied differed from each other in one or more characters. A total of 306 single-basidiospore isolates were obtained, but it was not possible to study all of them thoroughly; nevertheless there were obvious differences between most of them.

Obviously all biotypes that are included within the species S. rolfsii must have some consistent and visible characters in common. Mycelial characters and the production of a certain kind of sclerotium are the criteria for inclusion within the species.

Although having a few observable characters in common, the biotypes studied may differ in many characters, including particularly colony growth types, sclerotial characters such as color at maturity, location, number, shape, size, and surface markings, mutual effects between biotypes, aversion between colonies of biotypes, response to growth-promoting substances, and formation of the basidial stage.

The use of different types of media did not serve as additional indicators of biochemical differences between the biotypes. There were some differences on each medium tried, but the growth type character of each biotype was the same on each medium used.

The fact that so many of the 306 single-basidiospore isolates were distinct biotypes suggests that recombinations are common. Since 32 of the single-basidiospore isolates studied produced basidiospores, certainly the fungus can be considered homothallic, but whether it is always homothallic is unknown. If it is predominantly homothallic, the tendency should be toward greater uniformity rather than diversity. Mutation would then possibly account for much of the diversity.

A special study was not made of the degree of mutability, but observations made certainly lead to the tentative conclusion that easily observable mutation is much less common in S. rolfsii than has been reported for many plant pathogenic fungi. The 9 mutants observed in the many hundreds of cultures of S. rolfsii and the 3 in those of the "delphinii" group all had lost the ability to produce sclerotia. In one single-basidiospore isolate the inability to produce sclerotia seemed to be due to lack of ability to produce thiamine, as the addition of thiamine hydrochloride induced their formation.

The data presented in this dissertation show conclusively that Sclerotium rolfsii Sacc. comprises a large number of biotypes that differ in many cultural and in some physiologic characters. Whether they differ in pathogenicity is not yet known.

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AGRICULTURE, ANIMAL CULTURE

THE RELATIVE IMPORTANCE OF GENETIC AND ENVIRONMENTAL FACTORS ON THE BUTTERFAT PRODUCTION OF HOLSTEIN-FRIESIAN CATTLE

(Publication No. 5915)

Chen Kang Chai, Ph.D.
Michigan State College, 1951

It is generally recognized that both heredity and environment are important in the life of an individual and in the expression of various characteristics by the individual, and that their relative importance varies a great deal. Butterfat production of dairy cattle is considered as a characteristic that is inherited on quantitative basis and is highly affected by environment. Investigators have obtained different values as estimates of heritability of this trait

ranging from .17 to .86. Lush considered the intra-sire correlation and regression of daughter on dam method as the best estimate of heritability of butterfat production and he reported values between .17 and .28 for different sets of data.

Three Michigan State Institution Herds, the Traverse City herd, the Ionia Hospital herd, and the Ionia Reformatory herd, were established more than twenty years ago. The butterfat production of the cows in these herds has been measured and recorded. This data seemed to be quite worthy material for a study of the effects of various factors on butterfat production, in another sample of individuals under different environment than others. Therefore, this study was made which besides yielding a heritability estimate, separated various components of environment as far as this data permitted.

There were 473 daughter-dam pairs for the heritability analysis, 2299 records for the herd comparison and repeatability analysis, 1817 records for month and year effect on butterfat production, and 1071 records for the analysis of calving interval effect on butterfat production.

The pooled estimate of heritability of lifetime butterfat production for the three herds was .31 by intra-sire regression of daughter on dam method. Computed to a single record base, it is equal to a heritability value for single records of .17.

The herd differences accounted for about 26 percent of the total variance and the cow differences (intra-herd) accounted for 34 percent. These variances, of course, include both genetic differences and differences caused by environmental effects. The portion of variance accounted for by differences in records of the same cow (intra-herd) was about 66 percent.

The repeatability estimate was .34 on an intra-herd base.

Yearly differences accounted for about 5 percent of the variation in butterfat production. Though small, this value is statistically significant. No yearly trend was found.

Month of calving accounted for about 2 percent of the total variance. It was a significant effect. There was a rather definite pattern for the effect of different months of calving on butterfat production. The high peak was in March; this dropped gradually in the summer, increased in September, and fell again after that until January.

The relationship of calving interval and butterfat production was non-linear. The effect of calving interval on butterfat production accounted 15 percent of the variance for the same lactation, and 3 percent for the next lactation. Both were significant. 400 to 419 days seemed to be the most favorable interval as far as a single records were concerned.

The portion of variance accounted for by dominance and interaction in the above table includes a small portion due to permanent environmental peculiarities and also interaction between heredity and environment. Therefore, the portion accounted for by genetic effect actually should be less than 34 percent and for the environmental effects should be a little more than 66 percent.

Percentage of Total Observed Variance Accounted for by Various Genetic and Environmental Factors

Variance accounted for		Percentage
Herd differences		26
Genetic differences between herds	4	
Environmental differences between herds	22	
Differences within herds		74
Cow differences	25	
Record differences (within cow variance)	49	
		100
Environmental effects		66
Year of calving	4	
Month of calving	2	
Preceeding calving interval	3	
Present calving interval	15	
Others	42	
Genetic		34
Additively genetic	17	
Dominance and interaction	17	
		100

Since the records used for each kind of analysis are not exactly the same, and because an allowance must be made for sampling error, the figures listed in the above table can only be considered as approximate estimates.

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A STUDY OF THE RELATIONSHIP BETWEEN INBREEDING AND VARIABILITY IN THE MINNESOTA NO. 1 AND NO. 2 SWINE

(Publication No. 5529)

Homer David Fausch, Ph.D.
University of Minnesota, 1953

Data from the Minnesota Swine Breeding project including 311 litters comprised of 3295 pigs from the Minnesota No. 1 breed and 270 litters comprised of 2307 pigs from the Minnesota No. 2 breed of swine were analyzed to determine the effect of inbreeding on variability in these two breeds of swine. The data covered the fourteen year period from 1938 through 1951 for the Minnesota No. 1's and the ten year period from 1942 through 1951 in the Minnesota No. 2 breed.

The following six characters were studied: birth weight, weaning weight, weight at 154 days of age,

rate of gain from weaning to 154 days of age, body score, and feed consumption per 100 pounds of gain.

The data for each breed were divided into five groups each of which included a range of ten per cent inbreeding except in the No. 2 breed where the groups were F_1, Backcross, 10-19, 20-29, 30-39. The arbitrary groupings in the Minnesota No. 1 breed were: 0-9, 10-19, 20-29, 30-39 and 40-49.

Two criteria of variation were utilized, variance and coefficient of variation. There was a general trend in each breed for variation to increase in the groups having the highest coefficients of inbreeding. This was true in all characters studied except weaning weights in the Minnesota No. 2's 154 day weights in the Minnesota No. 2 breed and feed consumption per 100 pounds of gain in both breeds.

Four hypotheses were advanced to explain the increase of variation with increased inbreeding:

1. Variation due to recessive genes will increase with inbreeding until an inbreeding coefficient of about fifty per cent is reached in population having recessive genes at low frequency.

2. In many quantitative characters the portion of variance due to additive gene effects is small and any reduction in this portion of the variance may be completely masked by the much larger environmental portion.

3. Inbred animals may be more sensitive to fluctuations of the environment so that the more homozygous individuals may appear more variable.

4. Selection exercised may favor the more heterozygous genotypes so that the attainment of homozygosity may be attained more slowly than the advance of inbreeding coefficients would indicate.

Other data cited tends to support the conclusion that inbred animals are more sensitive to environmental variations since the inbreds have been found to be more variable than their crossbred offspring.

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ESTIMATES OF THE HERITABILITY OF GREASE FLEECE WEIGHT AND GRADE AND THE REPEATABILITY OF GREASE FLEECE WEIGHT IN SHEEP

(Publication No. 5931)

Ram Baran Prasad, Ph.D.
Michigan State College, 1951

Heritability estimates for grease fleece weight and grade and repeatability estimate for grease fleece weight were determined from sheep records from the Michigan State College sheep flock. The data included 1,599 records from 412 ewes of the Oxford, Shropshire, Hampshire and Southdown breeds, covering the period from 1933 to 1949. A study of the contribution of certain environmental factors to grease fleece weight was made and appropriate adjustments were indicated.

The study of environmental factors included the effects of age, number of lambs raised, breed and year on grease fleece weight. The least squares procedure of analysis was used to study these environmental effects and the following is the estimate of the effects of different environmental factors:

Statistics		Grease Fleece Wt. (lbs.)
General Means (Constant Environment)		7.28
Deviation from General Means for age	2 years	0.36
	3 years	0.46
	4 years	0.20
	5 years	0.04
	6 years	-0.42
	7 years	-0.64
Deviation from General Means for Breed		
	Oxford	0.94
	Hampshire	0.13
	Shropshire	-0.02
	Southdown	-1.05
Deviation from General Means for No. of Lambs Raised		
	Single	0.15
	Twin	0.02
	Triplet	-0.17

Deviation for General Mean for year of

Records made:-

1934	-0.151	1942	0.420
1935	-0.104	1943	0.230
1936	-0.727	1944	1.473
1937	-0.160	1945	1.304
1938	-0.583-	1946	0.345
1939	-0.636	1947	-0.071
1940	-0.253	1948	-0.211
1941	-0.165	1949	-0.711

The analysis of variance was done by the method of fitting constants and only the environmental factors which accounted for at least 6 percent of the total variations were considered to be important enough to justify adjustment in a selection program. The environmental factors that needed adjustment were breed and years in grease fleece weight. On comparison of the phenotypic parameters of grease fleece weight to grade it was found that the heaviest fleece weight was associated with the poorest grade. The phenotypic correlation coefficient between grease fleece weight and grade was estimated by correlating the two characters in the same animal and was found to be -0.35 ± 0.04.

Repeatability for grease fleece weight was estimated by the method of intra class correlation from records of 155 ewes of the Shropshire breed and this estimate was 0.44 ± 0.02.

Estimates of heritability, after adjusting for important environmental effects, were first made for each of the four breeds by the method of intra-sire regression of offspring on dam and intra-sire daughter-dam correlation. Then the weighted average of the four breeds and two methods were taken to give the best estimate of heritability. For grease fleece weight 169 daughter-dam pairs were used in analysis and the best estimate of heritability was found to be 0.38 ± 0.11. For grease fleece grade 167 daughter-dam pairs were used and the estimate of heritability was found to be $0.20 \pm .10$.

The genetic correlation was estimated by the formula:

$$r_{Gi\ Gj} = \frac{\frac{Cov_{i2\ jl} + Cov_{j2\ il}}{2}}{\sqrt{(Cov_{i2\ il})\ (Cov_{j2\ ji})}}$$

When the subscripts (1) and (2) represent the parental and fillial generation respectively and i, j are two characters. The estimate was found to be -0.37.

Under the assumption that 25 percent of the ewes are replaced each year with ewe lambs from the best 50 percent of the ewes and that the average loss due to death and accidents is 15 percent; the anticipated gain for a flock of 100 ewes in one year was estimated to be 0.17 pound for grease fleece weight and a little less than 0.10 unit for grease fleece grade. The gain in grade when interpreted in terms of the percentage of animals which may be expected to move up one grade in one year is a little less than 10 percent.

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AGRICULTURE, FORESTRY AND WILDLIFE

THE GEORGIA FORESTRY COMMISSION — OBJECTIVES, ORGANIZATION, POLICIES AND PROCEDURES

(Publication No. 5675)

Leon Abraham Hargreaves, Jr.
University of Michigan, 1953

The purpose of this study is to determine means of improving the administrative efficiency of the Georgia Forestry Commission. The Commission is a state agency which has embarked on a greatly expanded program in the past five years. This expansion has created numerous problems of an administrative nature.

The method of approach used in the study is the over-all management survey, which included the analysis of policies, organization, controls, staffing, procedures, methods, and physical facilities and arrangements. Data were obtained from the records and reports of the state forestry agency and from a series of interviews conducted with personnel at all the levels of supervision in the Commission. Recommendations based on these data were made on the various functions of the Commission.

General conclusions drawn from the study include:

1. The concentration of finances and planning on one program within an expanding agency will eventually bring about numerous problems of administration in the other programs of the agency.
2. Rapid expansion will be less expensive when it has been preceded by detailed but flexible planning of all phases of the work of the organization.
3. The lack of an adequate personnel program in an expanding agency will be a serious handicap to its efficient operation. This handicap will remain even if an adequate program is instituted after a part of the expansion has occurred.
4. Inadequate data for budget preparation can cause serious embarrassment if proper authorities decide to make detailed investigations of justifications for expenditures.
5. Rapid expansion may lead to the employment of personnel with lower qualifications than desired. This creates a problem of replacement when better qualified personnel become available.
6. It appears inevitable that a public agency of this sort must expect to lose a substantial proportion of its more promising personnel at the lower levels of the organization to the higher salaries of private industry.
7. Primary benefits derived by the administration of the agency from a study of this nature are:
   a. Aroused interest in administration among the personnel of the agency at all levels of the organization.
   b. Specific recommendations based on conclusive data.
   c. Recommendations for increasing the factual data available to the administration of the agency which can be used to increase the objectivity of future decisions.

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FACTORS AFFECTING LOCAL CONTROL OF WHITE PINE BLISTER RUST

(Publication No. 5560)

Donald Martin Stewart, Ph.D.
University of Minnesota, 1953

An extensive study was made of the feasibility of controlling white pine blister rust, caused by Cronartium ribicola Fischer, by eradicating Ribes spp. with and without supplemental removal of cankered areas on infected eastern white pine (Pinus strobus L.) in northern Minnesota.

On one area, burned-over 26 years prior to planting to white pine, the rust was effectively controlled by one eradication; and 12 years after removal of bushes only 6.4 per cent of the trees had cankers.

On a second area, burned-over one to two years before planting, control by eradication of bushes was either ineffective because of continual regeneration of Ribes within 5 years after the fire, or eradication was too expensive as a forest-disease control measure. This point is well illustrated on one site where an average of 10 bushes were removed the first time and 85 bushes were eradicated per acre a second time, 4 to 5 years after the first eradication. This regrowth originated principally from ribes seed stored under the duff and humus of the forest floor. The fire destroyed this organic mantle and exposed the seed to conditions favorable for germination of seed and growth of bushes. After eradication of bushes, an average of 27.5 per cent of the trees on the site with the least rust had cankers; whereas on the site with the most rust 67.5 per cent of the trees had cankers. Weather conditions were favorable for spread and intensification of rust in 1942, 1943, and 1944 and cankers predominated on the growth of those years.

The elapsed time between fire and planting of white pine is an important factor in the control of rust, and neither the planting of pines nor eradication of ribes bushes is advisable on recently burned areas.

The prevalence of rust in many plantations and natural stands of pine from which Ribes had been removed indicated that eradication alone would not protect enough trees to furnish satisfactorily-stocked stands; therefore studies were made in young forest plantings and an older natural stand to ascertain whether removal of cankers by pruning would be a feasible supplementary control measure.

To eliminate cankers from young planted trees, infected branches were cut off where the canker was 6 inches from the trunk; where a canker was nearer the trunk, branches were removed and the bark around the stub was excised. Where a canker was on an upper main stem, the top of the tree was lopped off below the canker margin. After 3 years 100 per cent of the trees in the first group, 69 to 100 per cent in the second group, and 95 per cent in the third group were canker-free. Results of the branch-trunk method were especially satisfactory, as 68.8 per cent of the scars were free of visible rust when cuts had been made only 0.1 to 2.0 inches from the canker margin.

Canker elimination was attempted on sapling-size natural forest trees by removal of diseased limbs only or by removal of all lower branches and those with cankers in the upper 5 whorls. Observations 6 years later indicated that the second method was more effective.

On certain sites where Ribes can be effectively and economically removed, supplemental elimination of cankers in young plantings is justified to insure well-stocked stands. Likewise, in well-stocked natural stands of high value from which Ribes can be removed at a reasonable cost, pruning is justified by the increased value of trees saved and by the resulting silvicultural benefits.

These studies show that, because of the diverse problem in controlling white pine blister rust in Minnesota, it would be advisable to re-examine policies in the light of the data obtained in the studies reported in this thesis.

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AN ECOLOGICAL STUDY OF THE LARCH CASEBEARER, Coleophora laricella Hbn. (LEPIDOPTERA: COLEOPHORIDAE)

(Publication No. 5756)

Frank Ernest Webb, Ph.D.
University of Michigan, 1953

The ecology of Coleophora laricella Hbn. and its role as an introduced defoliator of Larix spp. are described from studies carried on in New Brunswick from 1949-1952 and in the Lake States in 1950-1951. Since its introduction into North America sometime prior to 1886, the larch casebearer has spread within the range of eastern larch or tamarack, Larix laricina, as far west as Minnesota and points along the north shore of Lake Superior. Outbreaks have occurred every seven or eight years in the northeastern United States and eastern Canadian Provinces.

The systematic position of C. laricella is reviewed. Observations pertaining to the detailed life-history correspond closely with those of other European and American workers.

Eggs are laid in June-July. Larval growth conforms closely to a geometric progression. Two instars are passed in leaf-mines and the case-dwelling habit is adopted in late summer. The larvae overwinter in the third instar in the cases which are fastened to larch twigs. The fourth and ultimate instar occurs the following spring followed by pupation and emergence in late May and early June. Natural dispersal is by moth flight only.

Studies were made of all known factors regulating populations. The average sex ratio is slightly in favor of males. Small variations from this were found to occur between years and regions, and larger variations in favor of females in areas of heavy parasitism. The females are synovigenic and fecundity a function of longevity. Maximum oviposition noted for a single female was 113 eggs with the average slightly over 50. At least 50 native parasite species occur but none provides effective control. Of five introduced parasites, Chrysocharis laricinellae (Ratz.), and Agathis pumilus (Ratz.), are now widely established and exerting important control of outbreaks. Other control factors include predation of eggs by the nymphs of a Mirid and predation by insectivorous birds during the winter and early spring. Overwintering predation by birds in infestations in northern Michigan was as high as 74 per cent in mixed forest conditions but was significantly less in swamps. Weather is undoubtedly a major factor controlling population trends. Outbreaks have tended to occur

during periods of more-than-average rainfall in New Brunswick. Starvation is a major factor decimating populations in severe outbreak areas of recent establishment.

Population studies of intra- and inter-stand distribution involved counts of insects per fascicle of needles. Variation was greater within trees than between trees with the heaviest populations occurring in the lower crown. No differences in population intensity could be detected between different tamarack site conditions.

Damage is caused by the mining of the leaves by the larvae and is important only during the ultimate instar in early spring. Severe reduction of radial and shoot growth results from several seasons of sustained attack. It is unlikely that tree mortality is ever the direct result of casebearer injury owing to the ability of larch to withstand several seasons of defoliation and because feeding is finished prior to the completion of needle growth.

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OPTIMUM INTENSITY OF FOREST LAND USE ON A REGIONAL BASIS WITH APPLICATION TO A PORTION OF THE GEORGIA PIEDMONT

(Publication No. 5757)

Albert Cadwallader Worrell, Ph.D.
University of Michigan, 1953

The purpose of this study is to explore the possibilities of determining the intensity of forest land use which would be optimum from a social viewpoint, and of using this as a guide for conservation plans and programs. This optimum is conceived of as that intensity of forest land use which makes the maximum contribution to total economic welfare, but it is recognized that such an optimum also has social and political implications which must be considered.

The study was effectuated through an actual analysis of a ten county sample area in the Georgia Piedmont. Output-input ratios were determined for various levels of management intensity applied to the forest lands in this area. In successive stages, the variables of land productivity, present condition of forest stands, ownership, and external influences were introduced and their effects on the output-input relationships analyzed. Then, with allowance for imperfect markets and uncertainty of future conditions, the most efficient long-run pattern of forest land use for the area was determined and the regional forest management policy required to achieve this pattern outlined. Finally, the problems involved in a transition from present forest land use to the efficient long-run pattern and the social implications of such a change were explored.

The results of the analysis indicate that general economic welfare would be increased by growing timber on most of the forest land in the area. For any acre of this land taken alone, the more intensively it is managed, the greater its contribution to total welfare proves to be. But since the potential total production exceeds the estimated demand at normal prices, welfare will be greatest if intensive management is applied only to the larger ownerships and the most productive land and present condition classes, and the remaining forest land is managed at a low level of intensity. To allow for the uncertainty of future demand, some lands should be managed at a medium intensity so that their production can be expanded fairly quickly, if needed. Such a program would, in general, be compatible with other social and political objectives. However, it would require an immediately expanded public program of education and assistance to stimulate the private landowners to intensify their management.

Three conclusions may be drawn from this study. (1) Optimum intensity of forest land use in an area involves so many variables that its automatic attainment by the freely-working economic system appears unlikely. (2) Some form of guidance and control of forest land use in the public interest in inevitable, but the policy-making groups involved probably will fail to achieve the potential gain in general welfare unless they have some reliable concept of the optimum land use pattern to use as a goal. (3) A determination of optimum intensity of forest land use is feasible, though better information is needed than that now available if the results are to be reliable.

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ECOLOGICAL CONSIDERATIONS IN THE EXTINCTION OF THE PASSENGER PIGEON (Ectopistes migratorius), HEATH HEN (Tympanuchus cupido cupido) AND THE ESKIMO CURLEW (Numenius borealis)

(Publication No. 5759)

Duane Eugene Young, Ph.D.
University of Michigan, 1953

This study attempts to determine ecological factors resulting in the extinction of three avian species early in the twentieth century. Correlations between factors common to them are made. Discovered aspects are frequently compared with the plight of vanishing species faced with analogous situations today. The term "vanishing index" is suggested, explained, and used throughout as that point below which a species cannot decrease in population and recover.

Part I concerns the Passenger pigeon. Migration patterns, feeding, breeding and nesting habits are shown as colony adaptations. A theory of migration routes is proposed. Food was the driving urge for all movements, producing a "crop versus flight" ratio dependent on high-energy intakes. A raucous, pugnacious breeding system attracted predation, prevented crossbreeding in captivity. Possible subspeciation

is suggested. Reduction forces of natural and Indian predation, fogs and fires, were not disoperative to high populations. It is revealed that deforestation by white men resulted in destruction of food, concentration of flocks and easier access to nestings. Rapid transportation and the ability to trace the location of blocks by telegraph also contributed to man's ability to decimate the flocks. Such agents brought market hunting and the slaughtering of millions of birds. Lack of protective laws is evidenced. Rapid decline in populations disrupted colony existence, species disintegration followed, with the possibility of senescence, gene drift and sterility bringing the end. No disease conditions are indicated. Inability to adapt to environmental changes is disclosed as a major cause contributing to extinction.

Part II considers the Heath hen. They had made adaptations to natural forces. White men killed them for food, and as vermin, depleting them from the Atlantic coast mainland by 1832. On Martha's Vineyard Island their decline was due to fires during the brooding season, belated and inadequate legislation, weak refuge systems and bickering among wardens. Feral cats, abundant raptors, and abandonment by the State wildlife department when censuses revealed a population below 200, are examined. Disease, illegal hunting, senescence, sterility and an excess of males brought about extinction. Comparison is repeatedly made with the three extant variations in the genus. Factors responsible for extinction in the Heath hen are shown as operative today against the Greater, Lesser and Attwater's prairie chickens. Improper agricultural practices, successional changes in vegetation, and oil developments are rapidly reducing relict colonies. Extinction of the genus by the year 2000 may occur unless a public conscience develops to save them.

Part III deals with the Eskimo curlew. Commensal with the American Golden plover in migration, feeding and breeding, its greater palatability and lack of wariness brought heavy predation from white men. When Passenger pigeon millions declined these millions were substituted by market hunters. Internal adjustments of greater variability may have saved remnant flocks of the plover from destruction.

It is concluded no natural forces alone were strong enough to eliminate these species. Deforestation, market hunting by white men and lack of protective legislation were major forces reducing the millions to thousands. Natural forces continued the work, producing species debilitation and rapid extinction.

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AGRICULTURE, PLANT CULTURE

THE EFFECT OF LIME ON THE CHEMICAL COMPOSITION OF A CHARLOTTETOWN FINE SANDY LOAM AND THE EFFECT OF SEVERAL AMENDMENTS ON ITS CONTENT OF WATER-SOLUBLE BORON AS SHOWN BY SOIL AND PLANT ANALYSES

(Publication No. 5913)

Robert Frederick Bishop, Ph.D.
Michigan State College, 1953

Field, greenhouse and laboratory experiments were used to determine the results of liming a strongly acid soil and the effect of certain other amendments on its content of water-soluble boron.

The soil investigated, a Charlottetown fine sandy loam, is one of the best and most extensive agricultural soils on Prince Edward Island.

The field experiment, started in 1931, consisted of a three year rotation of potatoes, barley and clover. Limestone applications of 0, 500, 1,000, 1,500, 2,000 and 3,000 pounds per acre have been made periodically. Commercial fertilizer has been used for each potato crop and, since 1942, for each barley crop.

Chemical determinations made on soil samples taken in 1930, 1948 and 1951 included pH, exchangeable bases, base exchange capacity, total nitrogen and water-soluble boron.

Liming decreased soil acidity with the greatest amount of lime changing the pH value from approximately 5.0 to 6.0. Irrespective of the amount of limestone applied, decreases occurred in total nitrogen and exchangeable magnesium while exchangeable potassium increased.

From 1930 to 1948 water-soluble boron decreased approximately 30 per cent regardless of the amount of limestone applied. In 1948 a significant difference existed between the water-soluble boron content of limed and unlimed soils but not between soils receiving different rates of limestone.

The limestone treatments had little effect on soil acidity below plow depth.

Clover and barley yields were significantly increased by liming. This treatment did not affect potato yields but tended to increase the incidence of scab.

In a greenhouse experiment liming reduced boron availability as measured by plant and soil analysis. Two crops of ladino clover were grown and, although the calcium-boron ratios ranged from approximately 550 to 1 to 2,000 to 1, no visual symptoms of boron deficiency were observed.

There was a significant correlation between the water-soluble boron in the soil and the boron content of the clover.

The effect of calcium carbonate, magnesium carbonate, sodium hydroxide, gypsum, manure and alfalfa, on the water-soluble boron content of soil, was studied in a laboratory experiment.

Calcium and magnesium carbonates were equally effective in decreasing the water-soluble boron in soil. Gypsum was ineffective.

When the pH of the soil was raised from 4.70 to 7.32 with calcium carbonate the water-soluble boron decreased from 0.32 to 0.13 parts per million.

The water-soluble boron in soil was increased by applications of manure or alfalfa hay. The increases were proportional to the rates of application.

When expressed as parts per million of water-soluble boron, decreases occurring with calcium carbonate, whether applied alone or with manure or alfalfa hay, tended to be the same for any one rate of application irrespective of the amount of water-soluble boron present.

Applications of sodium hydroxide, to bring about a range of soil pH values from 4.82 to 9.72, were accompanied by decreases and then increases in water-soluble boron.

At comparable pH values of approximately 7.0 or less sodium hydroxide caused a smaller reduction in water-soluble boron than did either calcium or magnesium carbonate.

Calcium carbonate, applied to a soil previously treated with sodium hydroxide, caused less reduction in water soluble boron than where applied in the absence of sodium hydroxide.

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COMPARISON OF RECURRENT PARENT WITH DIFFERENT BACKCROSS GENERATIONS IN TOMATO

(Publication No. 5353)

Shigemi Honma, Ph.D.
University of Minnesota, 1953

Functional sterility ps is located in chromosome I, potato leaf c in IV, and green stem a_1 in V. The latter two characters are recessive markers used to identify seedlings that result from occasional self-pollination.

Material for the present study came from a program intended to transfer the three recessives to the variety Firesteel. By selecting for the three characters and backcrossing repeatedly, it was intended to add these characters to Firesteel without greatly modifying the variety. Firesteel was chosen because it seems to have a good general combining ability and therefore would be a desirable female parent.

Selection for the three characters and backcrossing to Firesteel were carried through four backcrosses. Because of sterility and therefore failure to fruit naturally the selections were evaluated by combining each in four test crosses. A selection from the F_3 of the first cross and from each backcross therefore has been tested for combining ability against the combining ability of the recurrent parent, Firesteel, and of the non-recurrent parent. They were crossed with Bounty, Break O'Day, Table Talk, and Stemless Pennorange. Sixty plants from each cross were grown in a triple lattice design with six replications. A total of 240 F_1 plants were therefore grown as hybrid progenies of each selection and of each parent. Data were taken on date of flowering, ripening date, early yield, total yield, yield of grade one fruit, and fruit size. The records were statistically interpreted by means of variance analysis as a randomized-complete-block arrangement and as a triple lattice arrangement.

Since the parents did not differ significantly for dates of flowering and ripening, no striking loss or recovery of these characters appeared in progenies of the backcross generations.

In yield characters the F_3 of the original cross was superior in comparison with other recovered lines, and was equal to Firesteel. Recovery of Firesteel combining ability therefore occurred at this point but declined as further backcrosses were made. A possible hypothesis for the decline is that genes of chromosome I, IV, and V have an important relation to the combining ability of Firesteel. Eliminating the dominant alleles of ps, c, and a_1 from the Firesteel genome gave a loss in transmitting yield. This assumes selection for whole chromosomes since crossing-over and linkage could not be studied. The fact that the loss did not occur sooner in the program may be thought of as due to complementary action of genes. Such interaction would need to be between genes from each parent and limited to that part of the genome not affected by selection. As backcrossing advanced there was elimination of genes from NC-1-48 F_3 except those selected for. By this loss there was disappearance of the interaction that gave the favorable combining ability shown by the first cross.

For fruit size, the parents differed in combining ability and recovery of Firesteel genotype occurred immediately in the backcross program. The first, second, and third backcrosses were slightly but significantly superior to Firesteel. The 50 per cent line and the fourth backcross did not differ significantly from the recurrent parent and probably should be considered its equivalent. From this behavior, dominant alleles of the recessives that were selected seem to have a minor role in relationship to the Firesteel genotype for fruit size.

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VARIABILITY AND INHERITANCE OF REACTION OF BARLEY TO CERTAIN RACES OF STEM RUST

(Publication No. 5547)

John David Miller, Ph.D.
University of Minnesota, 1953

Black stem rust, Puccinia graminis tritici Eriks and Henn, is a disease of some importance on barley. The recent rise in prevalence of certain races of

this fungus has emphasized the necessity of re-evaluating the reaction of available barley varieties to these races. Race 15B had demonstrated its virulence on common wheat varieties and since 1950 has comprised a large proportion of the rust collected in the North Central Region. Its virulence on barley, however, has not been established. Race 59A, on the other hand, has been shown in nursery trials to be very virulent on barley but as yet has not been high in prevalence in this region.

The present study was undertaken to locate sources of resistance to races 15B and 59A, to determine the effect of a relatively low (70°F) and a relatively high (82°F) temperature on reaction of barley to race 15B, to determine the mode of inheritance of reaction to race 15B, and to determine the association between reactions at various stages of growth for both races.

Race 15B

A group of about 250 varieties and strains from the Minnesota breeding program and from the World Collection of barleys were studied for the effect of temperature on reaction to race 15B in the seedling stage. There was not sufficient similarity between the reaction found on these seedlings to the reaction usually found on wheat to permit the complete adoption of the standard reaction types of wheat. The barley seedlings did not produce "green islands" characteristic of type 2 in wheat, and there was considerably more chlorosis around the large pustules in the barley seedling than is commonly true in wheat. Also there was often a rather wide range of reaction types on the same leaf. Hence, the reaction types were based primarily on pustules size. Although there was a tendency for greater susceptibility, there appeared to be a better differentiation between susceptibility and resistance at higher temperatures.

When the reaction of seedlings at either high or low temperatures was compared with the reaction of adults in the field, a statistically significant association was found. The same was true when the reaction of adult plants at high or low temperatures were compared with field reaction. However, perfect agreement was not present in any of the four comparisons.

The F_1 and F_3 generations of the crosses Minnesota 615 x Kindred and Minnesota 615 x Montcalm were studied both as adults and as seedlings. The F_2 generation was studied only as adults in the field. Minnesota 615 and Kindred were resistant or moderately resistant, whereas Montcalm was susceptible. Results of these studies indicate that one factor pair conditions reaction of barley to race 15B with resistance dominant.

The group of about 250 varieties for the Minnesota program and the World Collection were screened for sources of resistance to race 15B. Results of this test indicate that there are adequate sources of resistance and that the Tt factor pair seems to condition reaction to this race of rust.

Race 59A

A group of 1042 varieties from the World Collection plus 196 from the Minnesota program were screened for resistance to race 59A. A number of varieties and strains appeared to be resistant. Black Hull-less, Cereal Investigation Number 666, was outstanding in this respect.

The seedling reaction of the 1238 varieties to Race 59A at high temperature was compared with their reaction as adult plants in the field. A highly significant association was found.

Prevalence of rust on seedlings was not significantly correlated with prevalence on adult plants in the field.

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THE PHYTOTOXICITY OF ISOPROPYL N-PHENYL CARBAMATE AND RELATED COMPOUNDS ON WILD OATS (AVENA FATUA) AND THEIR SELECTIVE ACTION ON SEVERAL CROP PLANTS

(Publication No. 6165)

Allen Franklin Wiese, Ph.D.
University of Minnesota, 1953

The effectiveness of five phenyl carbamate herbicides for selectively controlling wild oats in field crops in Minnesota was studied in the following manner.

A preliminary trial in petri dishes showed that wide differences in tolerance to CIPC existed between wild oats and some crops. Field trials were set up to determine (1) whether the results of the petri dish study applied to preplanting applications of the chemicals, (2) what effect time of application other than preplanting had on selective action, and (3) how long herbicides remain toxic in the soil.

Laboratory and greenhouse studies were later undertaken to investigate some of the factors that modified results in field trials; i.e., (1) the relation of depth of corn and wild oat seed to placement of the chemical in the soil, (2) the effect of soil type and wild oat ecotypes on the response of wild oats to CIPC, and (3) the effect of CIPC on germination of dormant wild oat seeds.

A summary of the results follows:

Selective control of wild oats sown with a drill was possible on silt loam soil with preplanting applications of carbamates as low as 2.5 pounds per acre in sugar beets, soybeans, field peas, and sunflowers. It was impossible in corn, flax, wheat, barley, and oats because of injury to the crop. Where seeds occurred naturally throughout the plowed layer of Fargo silty clay loam, however, 10 pounds of the chemical were required. This amount injured sugar beets but not soybeans. Postemergence applications

of CIPC, IPC, and powdered IPC on flax were not successful, causing severe injury to the flax without controlling weeds.

Fall applications of IPC and CIPC for wild oat control in the spring were not successful because treatments that eliminated wild oats also killed cereals and flax. Treatments that were not toxic to domestic oats in the spring, however, reduced the stand of wild oats about 50 per cent. Fall applications of CIPC reduced the number of wild oat seeds in the soil at Crookston where a natural infestation of the weed occurred throughout the plowed soil.

Persistence of the toxic effects of CIPC, IPC, and 4-CIPC in the soil varied with the chemical, the amount applied, and the time of application. CIPC remained toxic in the soil much longer than IPC or 4-CIPC. Four-CIPC applied to the soil showed no effect on oats.

CIPC, applied to the soil, was effective only when in contact with the seed at the time of germination. Seeds below the level of the chemical in the soil developed normally. Soil types had an important effect on the response of wild oats to CIPC. The toxicity of the chemical was much greater in Hubbard sandy loam than in Fargo silty clay loam. Wild oat ecotypes from several locations in the state responded similarly to CIPC treatments. Dormant wild oat seeds were killed by soaking in a 2 p.p.m. solution of CIPC.

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AGRICULTURE, SOIL SCIENCE

EFFECT OF LIGNIN ON SOIL PROPERTIES AND PLANT GROWTH

(Publication No. 5938)

Ming Yuen Wang, Ph.D.
Michigan State College, 1953

Lignin prepared by saccharification of corncobs was mixed with surface soil from Miami sandy loam and Brookston clay loam at rates of 0, 2.5, 5.0, and 7.5 tons per acre. After five weeks' incubation, the soils were studied for changes in physical, chemical, and biological properties.

It was found that "lignin" caused an increase in the formation of large stable aggregates, an increase in the percentage of moisture at the moisture equivalent, an increase in the hygroscopic coefficient, and greater values for the upper and lower plastic limits and the sticky point. Percent porosity at tensions, 10, 20, 30, 40, and 60 centimeter water was increased whereas percent capillary porosity was decreased.

Addition of "lignin" to soil tends to increase slightly the base exchange capacity of the soil as determined by the ammonium acetate method. The increase was probably due to changes in the activity or adsorptive power of "lignin" during its transformation, or to the formation of certain complexes. The base exchange capacity of the "lignin" material used was 19 milliequivalents per 100 gram material.

The pH of the soils was slightly increased by the addition of "lignin". The pH of the "lignin" material was only 1.99.

Nitrate content of the soil, determined colorimetrically by phenoldisulfonic acid method, was decreased as rate of "lignin" application increased. This was believed to be due to immobilization of the nitrogen as a result of increased microbial activity.

Exchangeable calcium, magnesium (versenate titration method), sodium and potassium (flame photometer method) were not affected except potassium which showed a slight increase by "lignin" addition.

Buffer capacity of soil treated with "lignin" was increased, although not appreciably. The greatest buffer action of "lignin" lies between pH 6.5- 8.0.

Greenhouse experiments on surface soil from Miami sandy loam showed beneficial effect of "lignin" on the yield of tomatoes and spring wheat. Nitrogen, mulching, and liming increased the effectiveness of "lignin" on tomato yield but the latter two did not materially affect the effectiveness of "lignin" on the yield of spring wheat. Results of these experiments indicated that the optinum rate of "lignin" application was five tons per acre.

A comparison of crop yields when ground corncobs, sawdust, and "lignin" were applied at five tons per acre to surface soil from Brookston clay loam was studied under greenhouse conditions. The result showed that "lignin" was preferable to the ground corncobs and sawdust when mixed with soil. When applied as mulch, "lignin" and ground corncobs were preferable to sawdust.

A field experiment on Netea loamy sand was designed to study the effect of various mulching materials on the yield of soybeans. The results showed that when no nitrogen was added, corncobs, wheat straw, and sawdust mulching all tended to decrease yields. The depressive effect disappeared when 60 pounds per acre of nitrogen were applied. An increase at the rate of 120 and 180 pounds per acre.

It was therefore recommended that when "lignin" could be procured at reasonable cost, it can be used to advantage over corncobs and sawdust when applied at five tons per acre. Nitrogen application along with "lignin" would be beneficial.

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THE AUDITORY PATHWAY OF THE EPILEPTIC WALTZING MOUSE

(Publication No. 5722)

Muriel Dorothy Karp Ross, Ph.D.
University of Michigan, 1953

Young mice of the particular strain of Peromyscus maniculatus artemisiae described in this study exhibit both epilepsy and waltzing in response to audiogenic stimuli. Jingling keys provide an especially effective stimulus. As these mice become older they gradually lose their hearing. Finally, they become totally deaf and no longer are subject to either the epilepsy or the waltzing. The purposes of this study are twofold: 1) to determine the cause of the deafness, and 2) to attempt to relate any lesions found in the auditory pathway to tonal losses exhibited by the animals in life, using as a basis previous work of many authors on the pattern of projection in this pathway in higher forms.

Brains of partially deaf and totally deaf epileptic waltzers were compared with those of normal mice of a stock of Peromyscus maniculatus blandus. This report is based upon microscopic examination of eight brains: two from normal controls, four from partially deaf and two from totally deaf epileptic waltzers. Three of the partially deaf animals were tested for range of hearing and showed extreme high and low tonal losses. The brains were prepared for study according to the usual technical methods. Two brains, one from a normal control and one from a totally deaf epileptic waltzer were stained with cresyl-echt-violet, two from partially deaf epileptic waltzers were stained with toluidine blue, and the remaining four brains were prepared by Weil's method for medullated fibers.

Microscopic examination of the brains showed that there is a selective and progressive demyelinization of the fibers in the auditory pathways of the abnormal mice. This demyelinization is incomplete in the case of the young partially deaf epileptic waltzers, but is almost complete in the brains of older totally deaf animals of the same strain. The location of the degeneration in the auditory pathways of partially deaf animals, when compared with these tonal losses, indicates a pattern of projection in the auditory paths. This pattern appears to agree to some extent with the organization of the auditory pathways in higher forms. The special points of agreement are as follows: high tones appear to project to the dorsal part and low tones to the ventral part of the primary acoustic nuclei, and a rostrocaudal relationship appears to exist between pars principalis of the medial geniculate nucleus and the auditory koniocortex.

Aside from the conclusions that the cause of the deafness of the epileptic waltzers is anatomical in nature and that a pattern of projection appears to exist within the auditory pathway of the rodent, this study also indicates that the epilepsy is of "grand mal" type, with the locus of this phase of the disease in the auditory cortex.

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NORMAL AND DENERVATED SKELETAL MUSCLE, AND CONNECTIVE TISSUE OF MICE STUDIED BY HISTOCHEMICAL AND VITAL STAINING METHODS

(Publication No. 5564

Richard Hanawalt Swigart, Ph.D.
University of Minnesota, 1953

Tendon, ligament, sclera, dermis, dura, periosteum and perichondrium were vitally stained by trypan blue. Synovial linings, articular surfaces of articular cartilages and epiphysial cartilages were less heavily stained. Cartilage in other sites, bone (as studied in decalcified sections), and muscle were not stained. In vitro, trypan blue stained tendon but not adjacent muscle. Similar reactions occurred when routine histological sections were stained in a solution of trypan blue at pH 7. In contrast, solutions of trypan blue at pH 1 stained muscle but not tendon.

Injection of relatively large amounts of trypan blue two hours before death demonstrated that dye was retained first and in considerable quantity, in walls of blood vessels and in dense fibrous tissue such as tendon.

Muscle was more basophilic (toluidine blue at pH 7) and less acidophilic (ponceau 2R at pH 1-2) than dense fibrous tissue, and showed only a trace reaction to the periodic acid-Schiff's reagent technique (PA-S). The basophilia and acidophilia were reduced in staining intensity by prior proteolytic enzymic hydrolysis. Muscle showed stronger reactions for arginine (Serra-Thomas technique) and for tyrosine (or histidine) by the Diazo method.

Fibrous tissue that stained with trypan blue also showed a high level of acidophilia and a strong reaction to the PA-S-technique for polysaccharides. These reactions were reduced in staining intensity by prior enzymatic (trypsin and pepsin) hydrolysis of sections.

In vitro incubation of vitally stained tendon in a solution of trypsin released a considerable quantity of trypan blue. Hyaluronidase and pepsin released only a trace of dye. The histochemical staining procedures plus the results of enzymatic hydrolyses suggest that the vital staining resulted from binding of trypan blue to a protein-carbohydrate component of the connective tissue ground substance.

From the second through the fifth week of denervation muscle fibers showed a uniform decrease

in size and an apparent increase in the number of subsarcolemmal nuclei, many of which were swollen and contained pale chromatin and one or two nucleoli. Blood vessels were dilated and perivascular connective tissue was increased. The perimysium appeared thickened.

After 5 weeks' denervation, fiber size was no longer uniformly decreased, for now many very atrophic fibers as well as larger, rounded fibers with central nuclei were observed. Blood vessels were no longer dilated and engorged.

During the first 15 weeks of denervation some fibers were involved in the process of Zenker's degeneration.

Long chains of nuclei, possibly resulting from amitotic division, were evident in all of the material. Neuromuscular spindles remained intact for the total period of denervation.

A possible reduction of protein concentration in muscle fibers was evidenced by a decrease in reactions for arginine; tyrosine or histidine; basophilia and acidophilia.

The late stages of denervation were characterized by the presence of both large rounded muscle fibers with central nuclei, some actually appearing swollen, as well as many acutely atrophic fibers among which had been deposited a material which seemed to be predominantly connective tissue ground substance. There was little evidence that the latter process represented a complete connective tissue replacement for a few argyrophilic fibers were the only true fibrous elements observed.

Two types of vital staining (by an acid diazo dye) occurred. The first involved degenerating fibers in the early stages and probably indicated a type of reaction to injury. The second type of vital staining (occurring during the later stages of denervation) seemed to represent binding of the dye to the substance described here as connective tissue ground substance.

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ANTHROPOLOGY

PLURAL MARRIAGE AMONG THE WOLOF IN THE GAMBIA: WITH A CONSIDERATION OF PROBLEMS OF MARITAL ADJUSTMENT AND PATTERNED WAYS OF RESOLVING TENSIONS

(Publication No. 6175)

David Wason Ames, Ph.D.
Northwestern University, 1953

Polygyny, like other social institutions, needs to be considered in a broad cultural framework. The discussion therefore begins with the principal patterns of Wolof culture, and leads to tangential matters such as the factors governing the selection of mates, which are recognized by the Wolof to contribute to stability in marriage. For the same reason, there is a general consideration of intrasocietal status groups and of the implied sanctions for the perpetuation of status so that the configurations of rank within the polygynous household can be interpreted. The incentives and sanctions for the married woman working hard and well, for example, are for the most part supernatural, illustrating the necessity of a general cultural orientation, and indicating the intimate relations of such aspects of culture as economics and religion.

A somewhat detailed description of polygyny is projected against this general background of Wolof culture. Such matters as the frequency of plural marriages, the household arrangements, the status of wives, the consent of the first wife or other wives for subsequent marriages, and the rotation of the husband's attentions among the wives, are discussed. The daily routine and work year of the married woman, the rotation of household tasks among the wives, the distribution of family-owned property among the spouses, the patterns of authority and the distribution of disciplinary powers within the compound are also considered. Then the reasons for polygyny given by both men and women are discussed.

The principal and final consideration of the study are the problems of adjustment which arise among women who must share the same husband and who must work and live in propinquity, and the culturally patterned solutions to these problems. Polygyny, like any other arrangement for social living, has had to meet the pragmatic test of effectively ordering relationships of individuals or else be superseded by other systems. As Radcliffe-Brown and Forde state, "For a kinship system to exist, or to continue in existence, it must work with at least some measure of effectiveness. It must provide an integration of persons in a set of relationships within which they can interact and cooperate without too many serious conflicts. Tensions and possibilities of conflict exist in all systems." Polygyny, of course, establishes a social unit that is manifestly workable in many parts of the world, and certainly among the Wolof.

The problem, then, is to discover what tensions occus in Wolof plural marriages and how they are resolved. What are the institutionalized means of avoiding conflicts within the family and of dealing with those which arise? In terms of individual behavior, what does the husband do to reduce jealousy and envy among his spouses? How does the husband deal with an especially quarrelsome and jealous wife? How does a wife compete for the favor of the husband for herself and her children? To what extent do children become involved in this competition? To what extent do the wives cooperate with each

other in their work and maintain friendly relations with each other? What role do the husband's and wife's relatives play in relation to marital stability? These questions have cross-cultural significance which extends beyond the Wolof.

An effort is made to ascertain why these individuals act as they do and not simply what they do. Finally, the extent of good relations between spouses and the duration of polygynous marriages as compared with mongamous unions is given attention, with consideration here, too, of the motives that are the mainsprings of behavior.

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INTERMEDIATE PERIOD INFLUENCES IN THE NORTHEAST

(Publication No. 5832)

Edmund Snow Carpenter, Ph.D.
University of Pennsylvania, 1950

Supervisor: Loren C. Eiseley

One of the basic problems in the history of the native tribes of northeastern North America is that of explaining the intrusive linguistic and cultural position of the Iroquois. Here in the Lower Great Lakes and St. Lawrence region was a block of incorporating languages far afield from the nearest similar stock, the Caddoan-speaking people of the west watershed of the Middle Mississippi valley. It was also an anomalous position amid the loosely organized Algonkian and Siouan tribes of the eastern woodlands who were marginal to the broad area of horticultural tribes having clans with political functions, integrated group religious systems, highly organized ceremonialism, and maize festivals dominated by the idea of renewal and characterized by an annual cycle of first-fruits ceremonies marking crises in maize cultivation.

Older interpretations spoke of a late migration of Iroquoian people with a culture thought to have been fully-formed in the south and introduced in toto into the Northeast. At least three major objections undermine this view: First, on linguistic grounds the spawning of the Iroquois family must have been very ancient and probably occurred in the Ohio drainage system. Next, the Iroquois cannot be derived physically from the Indian stock which was most closely connected with the development and spread of the Middle Mississippi complex, but they must have left the Ohio region prior to this period. And finally, no archeological material suggesting a "pan-Iroquoian" type is known from any region other than historic Iroquoia. The early appearance of the maize industry and related developments in the Northeastern area suggest that Iroquois culture can be derived in situ from earlier complexes in the area.

But the ultimate origins of Iroquois culture do lie to the south in the direction from which corn came. And the linguistic evidence alone requires an actual movement of Iroquois-speaking people into the Northeast. Archeological data reveal successive southern influences, the major ones being experienced roughly in the following order: (1) an early complex of the Burial Mound 1 stage as seen in southwestern Pennsylvania, (2) the Middlesex complex, (3) the Glacial Kame complex, and finally (4) the Northeastern Hopewellian complex. Several must have involved actual migrations, possibly caused, in part, by ecological changes.

The last named complex constituted the largest manifestation and was shared by both northern and southern Iroquois regions. As such it stands as a favorite candidate for the distinction of having introduced the Iroquois tongue, hoe-economy and sib organization into their historic homelands. In addition to these migrations, southern traits continually reached the Northeast down to historic times. Since the emigres involved were generally farmers, and the traits and complexes which reached Iroquoia indirectly were generally related to the maize industry, such carriers and influences were channeled into the fertile farming lands, which later became historic Iroquoia. Thus, threads from various periods and distant regions were introduced into the north, there to be woven into the fabric now known as Iroquois culture. Many of the fibres still retain enough of their original character so that they may be traced backward in time.

Microfilm copy of complete manuscript of 157 pages, $1.96. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1012.

MATSUNAGI: THE LIFE AND SOCIAL ORGANIZATION OF A JAPANESE MOUNTAIN COMMUNITY

(Publication No. 5657)

John Bilheimer Cornell, Ph.D.
University of Michigan, 1953

Studies of Japanese mountain community life, such as this one of Matsunagi in the mountainous interior of south-central Japan, are rare in Japanese, and unique in English. This is both a description of the way in which the people of one socio-cultural unit live and an analysis of their social organization. Its chief purpose is to define local social features that also have a general validity in Japan.

In terms of the three-fold classification customarily applied to Japanese rural communities, Matsunagi is a "mountain" community, as against a "fishing" or "farming" (lowland paddy-farming) type; this characterization is primarily economic but it also involves other less precisely analyzed evaluations. At least, it is a practical, though unrefined, means of orienting the community to Japan.

Matsunagi was selected for community study as a mature settlement having physical compactness and modest size. Its 250 people show a clearly developed sense of belonging to the community. They live on a

500-meter plateau in the mountains of the "Middle Provinces" zone (Chugoku) of Honshu. They are conscious of connections with the region and with smaller culture areas which are, however, empirically ill-defined in relation to the Japanese matrix.

Most community data of this study were obtained in the course of ten months' intensive field investigation at Matsunagi and were supplemented by readings in Japanese language materials. The range of information embraces the economy, social organization, religion, and the life-history of the individual, but the emphasis lies on structural analysis of the society.

The inhabitants of Matsunagi practice a largely dry-field agriculture and such special upland industries as cattle breeding and forestry. Their economic existence is circumscribed by a diversified crop list, conservatism of material culture, and relative isolation. Though their "mountain" economy is primarily based on subsistence farming, this study shows that Matsunagi people are increasingly using money and machinery introduced to them through a multiplicity of contacts with the modern industrial nation. As a consequence, money and financial affairs now comprise a distinct economic sub-pattern.

The problem of identifying and characterizing community social features gives most meat for analysis. Social organization is treated as a structure of smaller groups. People orient their lives to three major sorts of aggregations: (a) the whole community; (b) intermediate sized groups, consisting of arbitrary administrative associations, voluntary groupings to accomplish some special economic or ceremonial purpose, and sodalities of individuals; and (c) the household group. Change is apparent in social life too: the intrusion of external elements has brought with it a tendency for community wholeness to be dissipated, leaving the intermediate groups to replace the whole in most community affairs. The characteristic contiguity and overlapping of these groups give social definition to restricted "neighborhoods," which are important foci of social relations. The household is economically and socially basic. Whether it is considered in relation to groups of kin or to groups of coresidents, the relationships are ties between households, and those of individuals are relatively unimportant. Whereas larger groups may be based either on kinship or common residence, the members of a household share both sorts of relationships; their solidarity is based on and organized as a family unit but is regarded as a series of complementary roles dependent upon common residence under one roof.

Analysis of community social structure, the principal motive in this study, produces two general conclusions: (1) the household is the pre-eminent group in community organization and is the true participant unit in community life; (2) as between the dual social determinants, residence and descent, the former is the more effective in Matsunagi, not only in general community ties but particularly in the field of kinship. Where such coresident ties are very close, they are accepted as kinship; and the relationship is usually indistinguishable from those of descent kin, even to the ritual and ceremonial functions reserved to relatives in Japan. The first is a fundamental character of Japanese social organization; the second is a social feature which the Japanese themselves have failed to grasp essentially.

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A STUDY OF THE RELIABILITY OF CULTURAL EVIDENCES FOR ARCHAEOLOGICAL-ETHNOLOGICAL CULTURAL CONTINUITIES IN THE EASTERN UNITED STATES

(Publication No. 5860)

Lynd J. Esch, Ph.D.
Indiana University, 1953

The Problem

The purpose of this study is to examine the process of establishing archaeological-ethnological culture continuities. This process is first approached from the theoretical point of view.

Comparison of the archaeological and ethnological processes indicates that both are subject to uncontrolled variation. The processes of observation and classification, which both fields employ, are used as the basis for rating scales indicating the degree of variation to be expected in the data.

It is found that an unobserved temporal and cultural interval generally separates the archaeological sequence from the period of ethnographic observation. Due to variation in the relationship of cultural change and temporal duration, and due to the variation in rates of change for various aspects of a culture, these factors cannot be relied upon as indicators of the degree or type of similarities to be expected in archaeological-ethnological comparisons.

It is only when the temporal stability of traits within an historic culture has been demonstrated that they may be compared with archaeological data with any assurance of reliability. This technique has been utilized in only one of the cases considered in this study.

It is found that the "direct-historical" approach is theoretically acceptable. However, its practical utility varies directly with the specificity of documentation. A rating system for documentation is developed.

In the second part of the study sixty-four continuity proposals, drawn from the Eastern United States, are evaluated by means of the rating scales. This rating system facilitates comparison of alternative proposals and offers a more objective technique for evaluation than has been previously employed in this field.

Conclusions

Analysis of the rating data indicates that:

1. The archaeological-ethnological cultural continuity proposals considered are the products of

marginal activities in the fields of archaeology, history and ethnology. The majority of proposals have been advanced by archaeologists.

2. These continuity proposals are generally of low reliability from the theoretical point of view.

3. This general low reliability is not necessarily due to the nature of the available evidence.

4. Techniques and data from the related fields could be employed in balanced, continuity-centered, research to produce continuities of greater reliability and hence, greater utility to cultural studies.

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THE CONCHERO DANCERS OF MEXICO

(Publication No. 5437)

Portia Mansfield, Ed.D.
New York University, 1953

The problem was to portray the culture, organization, ritual and dance of the Concheros of Mexico and to correlate these with their prehispanic past by means of sound colored motion pictures and a supplementary manual. The importance of the problem arises from the educators' responsibility of preparing citizens to live in peace and with understanding of other cultures. As religion, dance and song are components of a universal culture pattern, the study of those of other nations and races should give material for lessening prejudices and increasing appreciation.

The study was divided into four sub-problems: an inquiry into the prehispanic cultural background and the present-day culture, organization and ritual of the Concheros; an analysis of three dances, with musical accompaniments and description of costumes and properties; the production of colored sound motion pictures of the Concheros, their cultural patterns, rituals, prayers, hymns, dances and a pilgrimage to Guadalupe; the writing of a manual interpreting and supplementing the films. Both the motion pictures and the manual were to indicate the correlation between the present and the prehispanic past.

Though not much has been written about the Concheros, studies by Raul Guerrero trace back characteristic features of the organization and dances to several hundred years before the Spanish Conquest; and pertinent to the study, are some early eyewitness accounts by missionaries.

The investigator went to Mexico, gained the cooperation of Raul Guerrero, and Martha Stone and Alice Paul who have danced with the Concheros. She lived in the household of Alice Paul, and secured the cooperation of a Chief of the Concheros and was welcomed to participate in the activities of his group. It was thus possible to use direct observation and interviews and to record the information by notes, tape recordings and motion pictures.

Two sound colored motion pictures were produced. One deals with the cultural pattern of the Concheros, the other with their ceremonies. Three dances were analyzed and the music obtained and presented in the manual along with other information.

The Concheros are so named because, while they dance, they accompany themselves on a musical instrument called a concha. Here is an organization of many thousands of men and women, chiefly from the Central Valley of Mexico, who do, in high seriousness, a religious dance ceremonial, features of which have been traced back to the time when such dances were done before idols. The author concludes from her studies that there are parallels between the hereditary and hierachical organizations of the Concheros, and the organization of the pre-hispanic Indian monarchies and priesthood; that costumes and properties and dance formations resemble those described by early missionaries or shown in ancient Aztec pictures; that there is much to admire in the character of the Concheros, and in an organization and ceremonies which have survived so long, holding the participation of many people.

This study, including the motion pictures and manual, is offered as one concrete step toward promoting better relationships between the people of the United States and Mexico. It is not directed at any particular age level but for use in any educational situation. It is advised that the motion pictures be shown by a leader who has read the manual and who will lead the discussion.

Previews of these motion pictures indicate that adults and even small children receive aesthetic and social stimulation from them, therefore it is suggested that studies featuring motion pictures be made of other ethnic groups.

Microfilm copy of complete manuscript of 319 pages, $3.99. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1015.

THE CULTURE AND ACCULTURATION OF THE DELAWARE INDIANS

(Publication No. 5708)

William Wilmon Newcomb, Jr., Ph.D.
University of Michigan, 1953

This study has three purposes. The first purpose is to reconstruct the early historic culture of the Delaware Indians. The second purpose is to describe and analyze the acculturation of the Delaware. The third purpose is to describe the extent of Delaware participation in the modern phenomenon of pan-Indianism.

Data from Delaware informants, other ethnographic accounts, archaeological reports, and all available historic accounts are used to reconstruct the early historic culture of the Delaware. The same methods are used to describe Delaware acculturation.

The participation of the Delaware in pan-Indianism is studied by a questionnaire and by the usual ethnographic techniques. By using a questionnaire it is possible to rapidly ascertain the forces which are responsible for the appearance and growth of pan-Indianism.

Delaware technology and ideology are reconstructed in more detail than is Delaware sociology. A detailed reconstruction of early Delaware technology is possible because seventeenth century Europeans could understand and describe this aspect of culture. The data from archaeology are also of great help in describing early technology. Ideology is reconstructed with some completeness, particularly the religious beliefs and ceremonies. Since this aspect of culture lasted well into the twentieth century it could be fully described by ethnographers. Some segments of early Delaware social organization, particularly the kinship structure, are difficult to adequately reconstruct. This is so because the Europeans did not comprehend native kinship society and because these kinship institutions underwent relatively early modification. In general, a full and satisfactory reconstruction of early Delaware culture is made.

The internally unequal rate of Delaware acculturation is described. The technology and economy altered relatively soon becoming similar to and dependent upon Anglo-American civilization. Social organization was generally slower to change, but it was replaced by American institutions sooner than was the religious system. The religious system survived virtually intact until recent times. An analysis suggests the reasons for this type of acculturation. Some Oklahoma Indians, the Delaware among them, are losing their tribal identity and in its place are developing a super-tribal society called pan-Indianism. A survey of Delaware pan-Indianism indicates the forces which are promoting and retarding pan-Indianism among the Delaware.

Several general conclusions can be drawn from this study. 1) By utilizing all of the available information it is possible to reconstruct satisfactorily early historic Indian cultures. 2) An analysis of the acculturation of such a group as the Delaware, allows us to conclude that this process is explainable in cultural terms. 3) Pan-Indianism is becoming an important institution, and mechanism of sociocultural survival among some American Indian groups.

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A STUDY OF THE MOGOLLON CULTURE PRIOR TO A. D. 1000

(Publication No. 5409)

Joe Ben Wheat, Ph.D.
University of Arizona, 1953

Twenty-four pithouses were excavated near Point of Pines, east-central Arizona. Pithouses were rectangular or roundish, with narrow entrances, with vestibule entries, or with southern annexes. Two large ceremonial pithouses contained specialized floor features. Polished brown and red pottery were the principal local types. Closed-trough metates, ovoid manos, mortars, pestles, tubular stone pipes, grooved mauls, diagonally and side notched projectile points, pulping planes, choppers, and notched bone awls were characteristic tools.

Analysis of 264 Mogollon houses representing sites in six branches demonstrated consistent culture element constellations consisting primarily of those listed above. Eastern houses, with or without lateral entries, were usually roundish, western houses usually rectangular. Late houses in both areas were generally rectangular with long lateral entries.

Five technological horizons were established, characterized, in part, from early to late, by plain pottery, broad-line red-on-brown, narrow-line red-on-brown, red-on-white, and black-on-white pottery.

Evidence suggests that Mogollon Culture developed from Cochise Culture, was closely related to Hohokam in early periods. It heavily influenced Anasazi Culture in early times and was, in turn, strongly modified by Anasazi and Hohokam in later periods but maintained its basic integrity.

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PHOTOELECTRIC PHOTOMETRY OF PLANETARY NEBULAE

(Publication No. 5697)

William Liller, Ph.D.
University of Michigan, 1953

The brightnesses of fourteen planetary nebulae and the magnitudes and colors of their exciting stars have been determined photoelectrically in order to improve the basic data needed for the interpretation of these objects. The photometer, which was originally designed for use with the Heber D. Curtis Schmidt telescope, was attached to the Francis C. McMath 24-inch Cassegrain reflector of the McMath-Hulbert Observatory during this investigation.

The Bausch and Lomb Optical Company loaned the writer an all-dielectric interference filter with a half-width of 35A and with a maximum transmission of 81 per cent at λ4982, which isolated the [OIII] doublet at λ4959 and λ5007 very satisfactorily. With this filter it was possible to measure the intensity of the entire nebula in the light of this pair of spectral images alone. To determine the amount of light from the central star passing through this filter, the spectral region from λ5100 to λ6000 was isolated with glass and gelatin filters. Here there are only a few weak nebular radiations, and with existing photographic determinations of the relative intensities of these emissions, the brightness of the central star was evaluated. With computed central star colors the amount of radiation from the central star passing through the green interference filter was calculated. This quantity, when subtracted from the initial measurement, gave finally the brightness of the nebula in the light of the [OIII] doublet.

The spectral region from λ4100 to λ4330 was isolated with a standard interference filter, and the intensity of the central star was determined there as it was in the yellow. These two observations gave the color of the central star, and the yellow measurement yielded the visual magnitude of each object.

With these new results the temperatures of the central stars were calculated by using a method due to Zanstra. A model atmosphere was computed for a typical central star (T_0 = 35,000°K. and log g = 5.000) in order to test the Zanstra assumption that the star radiates like a black body to the short wave-length side of the Lyman limit of hydrogen. This assumption was found to be surprisingly good.

The average surface brightnesses of the nebulae in the light of the green forbidden oxygen lines were measured with a probable error of ± 3 per cent. With these values the photographic magnitudes of the nebulae were derived with an estimated average probable error of ± 0.1 magnitude and show that the earlier photographic determinations of the nebular magnitudes made by Berman are systematically too bright by an average of 0.7 magnitude. The brightnesses of the central stars listed by Berman are, however, in good agreement with those found in this investigation. The probable errors in the central star magnitudes determined photoelectrically range from ± 0.1 magnitude for the brightest central stars to ± 1.0 magnitude for the faintest objects. A larger telescope would make it possible to improve the accuracy of the results and to extend the observations to fainter planetary nebulae.

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A STUDY OF THE EFFECT OF ULTRA-VIOLET IRRADIATION ON IMMUNE RABBIT SERUMS AND HYPERSENSITIVE HUMAN SERUMS

(Publication No. 5636)

Jack Richard Battisto, Ph.D.
University of Michigan, 1953

A study of the effects of ultraviolet irradiation and heat upon serums of rabbits immunized with ragweed pollen extract and upon serums of humans hypersensitive to ragweed pollen has been carried out.

The abilities of the antiserums to precipitate homologous antigen, fix complement and passively transfer skin sensitivity to homologous and heterologous animal species were examined before and after treatment with ultraviolet light or heat. It was found that the precipitating activity of rabbit antiserums, their ability to fix complement and their ability to passively transfer skin sensitivity to other rabbits were impaired by ultraviolet light. However, their ability to passively transfer skin sensitivity to guinea pigs was unaffected. Heating the serums at 60 C for 12 hours did not seriously impair the precipitating activity nor the ability to transfer skin sensitivity to either guinea pigs or rabbits.

Globulin fractions of the serums retained the precipitating and the skin sensitizing activities. Relatively shorter exposures to ultraviolet light were needed to impair the precipitating and skin sensitizing activities of the globulins. However, experiments conducted with the globulins supported observations made with serums.

Human serums containing reagin to ragweed pollen lost their ability to transfer skin sensitivity to humans after heating at 60 C for 2 hours or after irradiation with ultraviolet light for 12 hours. Irradiating the serums for 12 hours did not destroy their ability to transfer skin sensitivity to rabbits. Again, experiments conducted with isolated globulins supported the observations made with serums.

An electrophoretic study on untreated, heated and irradiated rabbit serums and globulin fractions of these serums was conducted.

A study of the ability of certain substances to restore the immunological activities of immune serums and isolated globulins impaired by irradiation was made. Immune rabbit serums, irradiated to inhibit their precipitating abilities, regained the properties upon addition of either "normal" rabbit serum or guinea pig serum. Globulins fractionated from immune rabbit serum re-exhibited precipitating activity, after ultraviolet impairment, upon addition of globulins fractionated from "normal" rabbit serum.

No return of precipitating activity occurred after ultraviolet inactivation when "normal" serums, guinea pig serums or rabbit globulins, all heated at 56 C for 30 minutes were added or when a non-related protein such as gelatin was added. Cysteine was also incapable of restoring precipitating ability to serum exposed to ultraviolet light.

Immune rabbit serums irradiated to destroy their abilities to passively transfer skin sensitivity to rabbits did not regain these properties upon addition of either "normal" rabbit serum or guinea pig serum.

The conclusion arrived at is that ultraviolet irradiation is capable of destroying certain immunological abilities of blood serum while leaving others intact. One of the abilities, i.e., precipitation of homologous antigen, can be restored after ultraviolet irradiation damage.

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A PHYSIOLOGICAL STUDY OF CHLAMYDOMONAS CHLAMYDOGAMA BOLD

(Publication No. 5506)

Emily Jane Bell, Ph.D.
Vanderbilt University, 1953

Since it has become apparent that many of the fundamental aspects of metabolism may be studied profitably by the use of unicellular organisms, this investigation was undertaken to add further information to our knowledge of algal physiology. Chlamydomonas chlamydogama Bold, the organism selected for study, is a sexually-reproducing, heterothallic flagellate and a member of the order Volvocales and the family Chlamydomonadaceae. The alga was isolated by Dr. Harold C. Bold in 1947 and was grown under autotrophic conditions in a modified Bristol's medium. After some months of growth in this medium supplemented with liver extract, the alga apparently become heterotrophic, that is, it then required for its growth some compound or compounds present in liver extract. The heterothallic strains exhibiting this dependence on liver extract were designated L W16-1 and L W16-2 to distinguish them from the parent autotrophic strains which had been designated B W16-1 and B W16-2, the original mating types. Prior to the inception of the present investigation, it had been reported that strains L W16-1 and L W16-2 required vitamin B_{12} as well as the amino acids, aspartic acid and histidine.

The specific object of this investigation was to study the nutrition of C. chlamydogama and, especially, to confirm the vitamin and amino acid requirements of the "L" strains. The nutritional investigation was concerned with the optimum conditions for the growth involving hydrogen ion concentration, inorganic salt concentration, and inorganic and organic sources of nitrogen; a study of carbohydrate

utilization with the heterotrophic strain, and, finally, the mutagenic effects of the alkaloid, colchicine, on the autotropic and the heterotrophic strains.

By employing solutions of M/15 monohydrogen and dihydrogen potassium phosphate in various ratios, a series of media of varying pH values was prepared. The organism grew optimally in the medium which had an original pH of 6.98. By varying the amount of the salts in the basal inorganic medium, a concentration of 0.083% was found to support optimum growth. The following medium, optimum with respect to pH and salt concentration, was used in all subsequent experiments as a basal medium for the autotrophic strain:

K_2HPO_4	215.0 mg.
KH_2PO_4	109.0 mg.
$MgSO_4.7H_2O$	113.0 mg.
$NaNO_3$	375.0 mg.
NaCl	37.5 mg.
$CaCl_2$	37.5 mg.
Trace mineral solution	0.5 ml.
H_2O to make	1000.0 ml.

This medium supplemented with 0.1 mg./ml. of liver extract was used to maintain the heterotrophic "L" strains.

Five inorganic nitrogenous compounds were tested for availability as sources of nitrogen. Varying molar concentrations (0.01, 0.001, 0.0005 M) of KNO_2, KNO_3, $NaNO_2$, $NaNO_3$, and $(NH_4)_2PO_4$ were employed. Sodium nitrate at a concentration of 0.001 M supported best growth of the organism, although fair growth occurred with each of the concentrations of all the inorganic nitrogen compounds used. Subsequently, single additions of organic nitrogen compounds to the medium given above (with $NaNo_3$ omitted) showed that aspartic acid, asparagine, glutamic acid, glutamine, and peptone effected more luxuriant growth of the autotrophic strain than was obtained in a strictly inorganic medium.

The growth of the heterotrophic strain of C. chlamydogama was improved by the addition of various organic sources of carbon to the basal medium containing vitamin B_{12}. These included: glucose, starch, xylose, ribose, and sucrose. Growth was stimulated slightly by glucose 1 phosphate. No growth was obtained in any medium during incubation in the dark. Within a week after the cultures were returned to the light, significant growth occurred in both organic and inorganic media.

Vitamin B_{12} was found to be an essential growth factor for the heterotrophic strains. Growth equal to that observed in liver extract-supplemented medium was obtained by the addition of 0.1μ g./ml. of the vitamin. Contrary to the report mentioned previously, it was observed that aspartic acid and histidine were not absolutely required by the heterotrophic strains, although growth was slightly enhanced by these amino acids in the presence of the optimum amount of vitamin B_{12}.

An attempt was made to determine the nature (adaptation or selective mutation) of the development of the vitamin requirement by the originally autotrophic "B" strains. However, cultivation of the autotrophic strain B W16-1 for six months in the liver-supplemented medium resulted in no detectable change in nutritional requirements. It has been concluded, therefore, that the vitamin requirement arose by mutation.

In the presence of 0.2% colchicine in either a liquid or a semi-solid medium, there was a marked increase in the size of both the cell and the nucleus. This was interpreted as evidence for polyploidy. An increase in number of chromosomes as observed after treatment with the Feulgen stain substantiated this interpretation. Other cytological abnormalities were observed. These included: variation in size and number of zoospores, nuclear fragmentation, and variation in number of pyrenoids and stigmata. All abnormalities seemed to be temporary, for upon transfer to media containing no colchicine, cell division occurred and apparently normal algae were produced.

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THE IMMUNOLOGICAL BASIS OF RECURRENT HERPETIC INFECTIONS

(Publication No. 5531)

Garabed A. Garabedian, Ph.D.
University of Minnesota, 1953

Sera obtained from herpetic individuals invariably showed neutralizing and complement fixing antibodies in high titer. However, a correlation between the former and the appearance of recurrent eruptions in the same subject is difficult to establish. The antibody titers were much lower in non-herpetics, except in one case. The presence of a high neutralizing antibody titer in a serum, was always accompanied by a high complement fixing antibody titer.

The analysis by means of cross neutralization tests of 4 strains of herpes simplex which had been isolated on different occasions from the same person showed no antigenic dissimilarity among them.

Evidence was found in support of a linear relationship between the LD_{50} titer of herpes simplex virus and the PD_{50} titer of the antiserum used in successive neutralization tests. The recognition that within certain limits, a 10-fold increase in the LD_{50} corresponded to a 6-fold increase of the PD_{50} resulted in the acceptance of this ratio for the interpolation of the findings in cross neutralization tests. This simple method made easy the interpretation of the results.

The results of limited number of experiments indicate that a low grade local immunity exists in the skin, at the site and at the immediate vicinity of a healed herpetic lesion, but that this resistance can easily be overcome by a strain of higher dermotropic attributes. It was shown that this factor exists independently of the infectious titer, as determined in the mouse by intracerebral inoculations, and that it is not related to the antigenic constitution of the virus.

The successful isolation of the virus of herpes simplex in one instance during the interval between two herpetic recurrences, from apparently healthy epithelium, suggests that the agent was localized in normal tissues of a herpetic individual perhaps in an "imperfect" form. It was postulated that as a result of an insult to the tissues of the host and/or of a stimulus to the parasite, herpes simplex virus can undergo cyclic development to manifest itself by provoking a vesicle.

Experiments dealing with animal microphages and macrophages indicate that these cells phagocytose herpes simplex virus. That this same phenomenon could possibly take place in the human body, and that phagocytic cells might subsequently serve as vehicles for the dissemination of the infectious agent into the deeper tissues of non-immune individuals, was suggested. The experimental observation that the lethal effect of herpes simplex virus was enhanced when cortisone and mucin were incorporated with it in the inocula, substantiates this hypothesis.

A modified method for detecting complement fixing antibodies in human sera, by use of complement and hemolysin in excess and multiple aliquots of a suspension of sheep red blood cells, was described.

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SEROLOGICAL STUDIES ON AVIAN VISCERAL LYMPHOMATOSIS USING THE COMPLEMENT FIXATION REACTION

(Publication No. 5919)

Robert Francis Gentry, Ph.D.
Michigan State College, 1953

Mortality in chickens, resulting from avian visceral lymphomatosis, is of major economic importance to the poultry industry. Isolation and genetic resistance influence this mortality rate, but are not practical for the widespread control of the disease. The development of a diagnostic test would be a major contribution in this field, and this work was done in attempt to develop such a technique by use of the indirect complement fixation reaction.

Attempts were made to utilize the technique of Rice (1946) and Mayer (1947), both of whom employed the slope of the hemolytic curve in the calculation of the amount of fixation. The slope value was found to vary greatly, depending on the reagent present, and a technique was developed which eliminated the use of such a value. The amount of fixation was determined in terms of milliliters of undiluted complement necessary for 50 percent hemolysis by plotting the electrophotometer readings against the volume of undiluted complement present. From this the units of complement fixed could be calculated.

Influenza virus was employed for the standardization of the test technique. Rabbits were first used as a source of complement fixing antibodies, but were found unsuitable due to the formation of heterophile antibodies which reacted with heterophile antigen of the chicken serum. The production of these antibodies had been stimulated by heterophile antigen in the influenza virus suspension and had originated from the embryos used for its propagation. Guinea pigs were found not to produce this antibody and were used for subsequent inoculations.

Test antigens were prepared by extracting normal chicken tissue and tumors of RPL strain 12 visceral lymphomatosis (Burmester et al., 1946). They were used for the production of antiserums in guinea pigs, chickens, and ducks. Infected and normal chicken serums were also used as antigens, both in tests and for inoculations.

The first tests were designed to determine if the agent of the strain 12 tumor could be detected in the chicken serum. Infected chicken serum was used as an antigen and allowed to react with guinea pig antiserums that had been produced by the inoculation of normal and infected chicken serum and normal tissue and tumor extracts. Some reaction took place, but was due to the presence of normal tissue materials and not the result of tumor agent activity.

A direct test, employing tumor antigen and guinea pig antitumor serum was standardized for use in testing chicken antitumor serums for their tumor agent antibody content. A reaction, in excess of that due to the normal tissue materials was noted, apparently due to either tumor cell components or the agent.

Chicken antitumor serums were tested by the indirect technique, but no agent stimulated reaction could be detected. The reaction taking place was found to be due to normal tissue materials. Normal tissue antibodies were adsorbed from the guinea pig antitumor serum with normal chicken red blood cells, but when the adsorbed antiserum was used in direct reactions for the indirect titration of chicken antitumor serums, no difference was noted from the titers obtained with the untreated antiserum.

The detection of the agent of visceral lymphomatosis or specific antibodies was not possible with the techniques used, and will depend upon the development of more highly purified agent suspensions and the elimination of the normal tissue materials.

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LIGHT AND ELECTRON MICROSCOPIC STUDIES OF ESCHERICHIA COLI-COLIPHAGE INTERACTIONS

(Publication No. 5599)

Philip Emil Hartman, Ph.D.
University of Pennsylvania, 1953

Supervisor: Stuart Mudd

I. PREPARATIVE METHOD. COMPARATIVE LIGHT AND ELECTRON MICROSCOPIC CYTOLOGY OF THE E. COLI B - T2 SYSTEM.

A review of the past literature on cytological aspects of bacteriophage infection, emphasizing electron microscopic studies, points out the need for: (1) more carefully controlled conditions of infection, (2) improvements in preparative methods, and (3) improvements in the electron microscope itself, particularly with regard to contrast at high resolution. In the current study, Escherichia coli B and phages T2r$^+$ and T2r were grown on a tryptone-yeast extract- glucose medium. Electron preparations were made by growing bacteria on collodion overlying agar (Hillier, et. al. J. BACT. 56:569, 1948) and infecting them with a drop of phage suspension. This procedure permits manipulation of the specimens and, at the same time, preserves the intimate relationships existing in both cell structures and infecting virus. Comparative growth curves on collodion and in broth were similar in essential features. Nuclear stains were made by a modified Feulgen and by the DeLamater (STAIN TECH. 23:161, 1951) techniques. The nuclear changes upon infection, as previously observed by several workers, were confirmed.

II. THE ELECTRON MICROSCOPIC CYTOLOGY OF THE E. COLI B - T2 SYSTEM.

An electron microscope objective modified from that of Hillier (J. APPL. PHYS. 22:135, 1951) was used for high contrast micrography. Special printing techniques were necessary to bring out detail in thick and thin areas of the specimen and are described. Twenty-two shadowed and unshadowed electron micrographs made at five minute intervals post-infection demonstrate the changes taking place inside of phage-infected cells. Uninfected cells showed the patterning previously described (cf. Mudd, et al. J: BACT. 60: 635, 1950). During the first half of the latent period, marginal vesicular areas replaced the alternating dark and light patterning of normal cells. No intracellular phage was visible as such during this time but much of the cell protoplast was still highly electron scattering. The latter half of the latent period was characterized by gross changes in the texture of the cytoplasm and by the gradual internal build-up first of phage "Anlagen" and second of mature phage progeny. Progressively during infection, the cells enlarged, flattened to a greater extent in drying on the membrane, and become more electron-transparent. Interpretations based on the micrographs are compared and found to be in agreement with observations garnered by others by diverse methods (genetic, biochemical, physical, etc.).

III. PERSISTENCE OF MITOCHONDRIA AND REDUCTASE ACTIVITY DURING INFECTION OF E. COLI B WITH T2 PHAGE.

The activity of flavoprotein enzymes capable of reducing 2,3,5-triphenyltetrazolium chloride was found to remain at a constant level during the latent period of T2r infection of E. coli B growing in unaerated complex medium. Microscopic examination revealed that, while the nuclei were disrupted early in the latent period, the tetrazolium reductase activity of the mitochondria (Mudd, et al. J. BACT. 62: 729, 1951) persisted in discrete loci until lysis of the cells. This emphasized the individuality of nuclei and mitochondria in E. coli. Some oxidative mitochondrial functions of the host cell not inhibited during infection are proposed as probably essential to intracellular elaboration of phage.

This work was performed in collaboration with Drs. Stuart Mudd, James Hillier, and Ernst H. Beutner and under the supervision of Dr. Mudd. Electron micrographs and further details concerning the study may be found in BIOCHIM. BIOPHYS. ACTA 10:143, 153 (1953) and J. BACT.: In press (1953).

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A STUDY OF THE PLASTIC CARD METHOD FOR THE DETERMINATION OF THE HUMAN BLOOD GROUPS

(Publication No. 5921)

Erma Marguerite Hill, Ph.D.
Michigan State College, 1953

A study of the plastic card method of Levinson and Schultz for the determination of ABO and Rh_o blood groups was conducted to determine whether or not the technique could be safely used in a mass blood typing program. The method offered the advantage of a rapid test performed at the site of blood procurement and a permanent record of the results obtained. To evaluate the accuracy and adequacy of the plastic card method a statistically significant number of results were compared with those found by standard test tube procedures using bloods from the same individuals. The cards were of cellulose acetate, 8.5 cm. x 6.0 cm. x 0.015 mm. They were provided with spaces for the permanent record of name of the donor, date, results of the tests, and properly labelled printed circles for each of the blood grouping tests.

A preliminary study of the plastic card method for the determination of ABO and Rh_o blood groups of 8,891 individuals was performed under field conditions using locally recruited and trained field personnel. An analysis of the data indicated the potentialities of the plastic card method and sources of error in the method. The need for well trained and experienced personnel was indicated.

A second study was conducted in the field under re-defined conditions. The blood groups of 9,653 individuals were determined by the plastic card method, and the results were compared with those independently obtained by laboratory tube methods. When discrepancies existed between the results, the laboratory blood specimens were subjected to more extensive study of the blood groups, using multiple antiserums and anti-globulin tests, and second blood specimens were obtained from the donors whenever possible.

In the final study a technical error of 0.16 percent and a total error of 0.49 percent, when inconclusive results and clerical errors were included, was found in the plastic card method for the determination of ABO and Rh blood groups as compared with standard tube methods.

The effect of red cell, antiserum, and albumin diluent concentration and the physical variables of time, temperature, and admixture was studied in a laboratory investigation of the limitations of the plastic card method.

The plastic card was examined as a medium for Rh antibody determination, Coombs anti-globulin testing, and study of weakly reacting $Rh_o(D^u)$ antigens. When the results were compared with results obtained both by standard tube and warm slide methods, it was found that the plastic card method was somewhat less sensitive than the tube methods but approximately comparable to the warm slide method both for antibody titration and for the anti-globulin test. However, the plastic card was unsatisfactory for the detection of weakly reacting $Rh_o(D^u)$ antigens.

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THE NOVY RAT VIRUS: ITS RECOVERY AND CHARACTERIZATION

(Publication No. 5684)

Russell Thomas Jordan, Ph.D.
University of Michigan, 1953

Several years ago in this laboratory, Dr. F. G. Novy isolated a virus from rats which was maintained by serial passage in normal rats. During the course of passage the virus was presumably lost. The purpose of this thesis is to report the results of studies designed to characterize an infectious agent, recovered by passage of glycerinated blood which had been obtained from rats infected with the above virus, and had been sealed in glass tubes and stored in a laboratory cold room. The existence of these tubes had been unsuspected for a number of years; they were found during changes associated with a reorganization of the laboratory. According to the labels found on the tubes the glycerinated blood mixture had been preserved by Dr. Novy in the period between 1914 and 1918.

The recovered filtrable infectious agent has been named the Novy Rat Virus. Although it was shown to be predominantly neurotropic, causing in susceptible animals the greatest amount of damage in the central nervous system, other organs of the body were involved to a certain degree. The virus caused fatal infection in young rats and mice when inoculated by any route; susceptibility to extraneural inoculation of virus was shown to decrease with increasing age of the animals. Guinea pigs, rabbits, chickens, and the developing chick embryo were susceptible to the lethal effects of the virus.

Methods used to characterize the infectious agent included ultracentrifugation studies which demonstrated that the virus could be sedimented at 42,000 times gravity. Electron microscopic examination of the sediment from allantoic fluid infected with the virus revealed spherical particles measuring 35 millimicrons in diameter. The virus was filtrable through Berkefeld and Seitz filters; its diameter as estimated by filtration through gradocol membranes, was determined to be approximately 18 to 26 millimicrons.

In studying the effect of hydrogen ion concentration on the infectious agent it was found to be most stable when suspended in buffer solutions ranging in pH between 7.3 to 9.7. Experiments designed to determine resistance of the virus to chemical disinfection under different conditions of temperature and exposure showed the virus to be resistant to 0.25 percent formalin for two hours at room temperature; it remained active in chloroform and phenol at 3-5° C for five and seven weeks respectively.

Brain suspensions of the virus resisted heating at 56° C for 30 minutes, but were inactivated at 70° C in ten minutes. The virus retained its infectivity after 11 months storage in the frozen state at -55° C and for the same length of time when mixed with glycerine and stored at 4° C.

Serological studies, which included virus neutralization and cross protection tests, indicated the Novy virus to be antigenically distinct from Mengo, Semliki Forest, Venezuelan, or western equine encephalomyelitis viruses.

Results of intracerebral cross protection tests showed that some immunological relationship exists between the Novy virus and eastern equine encephalomyelitis virus, since mice vaccinated against the Novy virus resisted 50,000 LD_{50} of the eastern virus given intracerebrally. However, homologous challenge revealed a resistance index of 3,200,000 indicating a significant quantitative difference between the two viruses.

On the basis of its pathogenicity for experimental animals, its immunological reactions so far studied, and the lesions which it induces, the Novy virus is believed to be a new virus, significantly different from other known viral agents, but with some serologic relationship with the eastern equine encephalomyelitis virus.

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THE GROWTH OF PLEUROPNEUMONIA-LIKE ORGANISMS OF HUMAN ORIGIN

(Publication No. 5602)

Robert Keller, Ph.D.,
University of Pennsylvania, 1953

Supervisor: Harry E. Morton

I. CULTIVATION IN THE DEVELOPING CHICK EMBRYO.

Six strains of Pleuropneumonia-like organisms (PPLO) originally isolated from the human genito-urinary tract were successfully grown in 9 to 11 day old developing chick embryos. The method of inoculation was the intra-allantoic route. From a quantitative comparison of growth in the chick embryo and on an artificial medium it was concluded that the strains grew essentially equally well in both cases, and that there was no deficiency in the artificial medium which the chick embryo could supply. Some of the strains were inoculated intra-allantoically and the chick embryos allowed to hatch. Although PPLO could be isolated from the developing chick embryos during all stages of development, no significant percentage of mortality or obvious changes in the state of health of the newly hatched chicks could be noticed. There are some reports in the literature of the production of intracytoplasmic inclusion bodies by this group of organisms. Some studies on this problem were made by cultivating the strains of PPLO on the dropped chorio-allantoic membranes of chick embryos. Impression smears of these membranes stained by the Gram, Giemsa and Wayson methods yielded inconclusive results.

II. AN IN VITRO GROWTH CYCLE.

A review of the highly contradictory literature on the cytology and the postulated reproductive cycles of the pleuropneumonia group of organisms pointed out the need for some quantitative determinations on the growth pattern of this group of organisms. Quantitative determinations on the growth cycle of PPLO from human derivation were made by (1) a turbidometric method, (2) an estimation of viability by noting the ability of dilutions of aliquots taken from the growth flask to manifest active proliferation, and (3) a viable count by a volume to area plate count method. Inspection of the curves plotted by these last two methods indicated that PPLO follow a bacterial growth cycle. Under the conditions of the experiment there was evidence for a lag phase of 8 hours, a logarithmic phase of 45 hours and a stationary phase of 19 hours. The turbidometric determinations showed that all the measurable turbidity occurred at 40 to 48 hours. The possible reasons for this late increase in turbidity are postulated. The entire results are discussed in the light of the cytological literature. Assuming binary fission to be the sole method of reproduction the generation time during the logarithmic phase was calculated to be 3.27 ∓ 0.78 hours.

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PURIFICATION AND PROPERTIES OF BACTERIAL UREASE

(Publication No. 5482)

Alworth Duane Larson, Ph.D.
State University of Iowa, 1953

A method for the purification of bacterial urease from Bacillus pasteurii has been developed. The purification procedure involves fractionation with ammonium sulfate and acetone, removal of nucleic acids with protamine, and adsorption and elution of the enzyme from calcium phosphate gel. The activity of the most active fractions of bacterial urease ranged from 150,000 to 190,000 Sumner units per gram of protein. The most active preparations of jackbean urease have activities of 100,000 to 133,000 Sumner units per gram of protein. The finding that bacterial urease has a higher activity than urease from other sources is paralleled by the fact that bacterial catalase has an activity of twice the catalases isolated from other materials.

Some properties of the bacterial urease have been determined. The Michaelis-Menten constant has been established as 0.010 M at pH 5.7, 0.013 M at pH 6.7 and 0.004 M at pH 7.7. Cause for the variation of the constant has not been established.

The hydrolysis of urea by bacterial urease is a zero order reaction as is the case with jackbean urease. Within the temperature range of 10 to 50°C the Q_{10} values and the energies of activation have been calculated and compared to the literature values for ureases from other sources.

Since bacterial urease has high activity and is evidently present in Bacillus pasterurii in significant quantity the probable role of urease in the metabolism of the organism is briefly discussed.

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METABOLIC STUDIES ON THREE STRAINS OF PLEUROPNEUMONIA-LIKE ORGANISMS ISOLATED FROM MAN

(Publication No. 5606)

James Giacomo Lecce, Ph.D.
University of Pennsylvania, 1953

Supervisor: Harry E. Morton

The difficulty of obtaining pleuropneumonia-like organisms (PPLO) in large numbers and of measuring their metabolic activity has undoubtedly contributed to the paucity of information concerning their

metabolism. Using triphenyltetrazolium chloride as an indicator of enzymatic oxidation, a lactic acid oxidizing system was the first to be observed. This system was therefore used for more detailed studies of optimum conditions for the oxidative activities of this organism. Resting cells of the comparatively fast growing Campo strain were prepared by sedimenting broth cultures, washing, and resuspending in phosphate buffer. The turbidity of the resuspended organisms was equated to mcg cellular nitrogen using a previously established curve. A growth cycle was studied by measuring the increase in cellular nitrogen. Simultaneously, gross viability of the culture and the enzymatic activity of resting cells harvested at various stages of growth were determined. Optimum oxidative activity of the resting cells toward lactic acid occurred over a rather narrow range of the growth curve. The cellular nitrogen continued to rise slowly after the gross viability apparently had begun to decline. Good results were obtained by adjusting the inoculum so that the lag phase lasted approximately 24 hours. The cells were harvested 8 to 16 hours after the end of the lag period. The optimal substrate concentration, cell concentration, and pH were determined for the maximum reduction of triphenyltetrazolium chloride. These various optima were then applied to the study of other substrates. Resting cells of PPLO showed surprising activity in the presence of shortchained monohydric alcohols, less activity with lactate, ribose, fructose, and no activity with glucose. This pattern has been found in 3 strains to date. The presence of catalase was demonstrated. The transfer of electrons from ethyl alcohol to oxygen by suspensions of PPLO was cyanide sensitive. An examination of crude cellular extracts revealed the presence of a DPN-linked alcohol dyhydrogenase and a sluggish lactate dehydrogenase which is not DPN-linked. No TPN-linked systems were demonstrated.

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A STUDY OF THE ADENOSINE-TRIPHOSPHATASE ACTIVITY OF LEUCOCYTE NUCLEI FREE HOMOGENATES OF THE GUINEA PIG AND THE RAT

(Publication No. 5705)

Makio Murayama, Ph.D.
University of Michigan, 1953

The first purpose of this investigation was to determine whether or not ATPase was involved in the metabolism of phagocytic cell in inflammatory exudates of guinea pig and rat. When ATPase had been partially characterized, the effect of cell fractions of pathogens on this enzyme was studied. In other words, the second purpose was to find out if a given fraction of a parasite influences the enzyme (ATPase) systems of the WBC of a resistant animal differently than those of a susceptible host; this would be an important factor in understanding a link in the chain of reactions of resistance to infection.

Techniques are presented for obtaining leucocytes and for preparing WBC nuclei free (n.f.) homogenate. A micromethod for ATPase assay is also described.

ATPase activity has been found in the leucocyte (n.f.) homogenate of the guinea pig and the rat. The maximum activity of ATPase was attained in the alkaline region, pH about 9.5. The enzyme was magnesium activated. Since the activity of ATPase was partially inhibited by p-chloromercuribenzoate at 10^{-3} M, it appears to be a sulfhydryl activated enzyme. KCN in the concentration range of 10^{-6} to 10^{-3} M activated ATPase in WBC (n.f.) homogenate. Both ascorbic acid and glutathione were found to be an excellent activator of the enzyme.

A comparative study was made of the specific polysaccharide of the virulent (SI) and avirulent (SI-L4) strains of D. pneumoniae and of a fraction of B. anthracis thought to be associated with its virulence on ATPase activity of leucocyte (n.f.) homogenate of the guinea pig and the rat.

Since the susceptibility of the rat to Type I D. pneumoniae is about a million-fold greater than that of the guinea pig, it was interesting to find that the ATPase in rat WBC (n.f.) homogenate was inhibited by SI, but on the other hand, this polysaccharide activated ATPase activity of guinea pig WBC (n.f.) homogenate.

Polysaccharide from an avirulent Type I pneumococci (SI-L4) activated ATPase activity in the rat WBC (n.f.) homogenate. This polysaccharide does not affect ATPase activity in guinea pig WBC (n.f.) homogenate.

With respect to B. anthracis, the guinea pig is a susceptible host and the rat is resistant; this fact was responsible for studying the effect of an anthrax antigen on ATPase activity in the guinea pig WBC (n.f.) homogenate. The converse was true for the rat leucocyte (n.f.) homogenate ATPase activity.

It can be concluded that there is ATPase, the energy-releasing enzyme, present inside the white blood cell. Furthermore, the present study indicates that fractions generally believed to be associated with virulence of certain parasites may alter ATPase activity in white blood cells. Thus, it is probable that the effect exerted by such fractions of the parasite on ATPase activity of leucocytes of a given host might be one of the several factors which determine whether or not an organism is virulent for a given host.

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THE INFLUENCE OF THE B GROUP OF VITAMINS ON THE PRODUCTION OF PYOCYANIN, GROWTH, AND VIRULENCE OF PSEUDOMONAS AERUGINOSA

(Publication No. 5824)

Marjorie Mary Nemes, Ph.D.
Lehigh University, 1953

The effects of nutritional factors on pigment production by Pseudomonas aeruginosa has been studied extensively. This investigation is concerned with the influence of the B group of vitamins on pyocyanin production, growth, and virulence of Ps. aeruginosa. This group of vitamins included thiamin, riboflavin, pyridoxine, nicotinamide, pantothenic acid, para-amino-benzoic acid, folic acid, biotin, inositol, and Vitamin B_{12}. The biosynthetic ability of Ps. aeruginosa for the B group of vitamins was determined by conventional microbiological and chemical methods.

The test organisms were grown in 10 ml of basal medium containing by weight per liter:

Glycerol	10.0 gm.
Glycine	4.0 gm.
1-Leucine	8.0 gm.
dl-Alanine	4.0 gm.
Dipotassium hydrogen phosphate	0.40 gm.
Magnesium sulfate heptahydrate	20.0 gm.
Ferrous sulfate heptahydrate	0.10 gm.

to which varying concentrations of the vitamins were added. Incubation and aeration were done on a constant temperature reciprocating shaker for 96 hours at 21 $\pm$ 2°C as previously determined. Five independent runs for each vitamin at varying concentrations were made.

The cultures were centrifuged, the cells washed repeatedly with sterile normal saline and finally suspended in 10 ml of normal saline. To determine the influence on growth, serial dilutions to 10^{-5} by conventional methods were done, 1 ml beigh used for five replicate nutrient agar pour plates. The colonies were counted after 24 hours incubation.

Pyocyanin concentration was determined spectrophotometrically following chloroform extraction of the supernatent fluid.

One milliliter of the saline cell dilution ranging to 10^{-4} was injected intraperitoneally into Albino Swiss mice. After 24 hours, the number of deaths at each vitamin concentration was recorded.

The findings in the investigation of the role of the B group of vitamins on the nutrition of Ps. aeruginosa indicates a decided influence on the cell oxidation processes which in turn influences the pyocyanin production since pyocyanin is the major respiratory enzyme of Ps. aeruginosa. This is evidenced by the increase in pyocyanin production brought about by the addition of vitamins to the basal medium. The studies have indicated the mineral concentrations at which each particular member of the B group stimulates pyocyanin production. These are listed as follows:

Vitamin	Conc. MUG/ml
Thiamin	5.5-6.5
Riboflavin	0.5
Pyridoxine	0.125
Pantothenic Acid	2.0-2.5
Nicotinamide	1.0
Para-amino-benzoic Acid	0.075
Folic Acid	0.1
Biotin	0.1-0.2
Inositol	0.1-0.3
Vitamin B_{12}	0.025

Under the conditions of the experiment and the methods used, the vitamin requirements of Ps. aeruginosa reflected the ability to synthesize these nutrilites. In the interpretation of the various concentrations of the B group of vitamins on pigment production and growth, it can be said that the nutritional requirements for a given essential organic metabolite, in this case, vitamins, is conditional not only on its rate of synthesis, but also on the rate of synthesis of other essential metabolites which are beyond the experimental control of any biological system. The studies showed the relationship between the requirement of an essential metabolite and the organism's ability to supply it either by biosynthesis or acquisition from the environment, that is, when it is included in the synthetic medium additively.

The investigation showed a stimulatory effect by nicotinamide, riboflavin, folic acid, biotin, pyridoxine, and Vitamin B_{12}; thiamin, pantothenic acid, para-amino-benzoic acid, and inositol were not synthesized in sufficient amounts for pigment production and thus constituted a nutritional requirement. Growth promotion was influenced by nicotinamide, pantothenic acid, riboflavin, folic acid, biotin, para-amino-benzoic acid, pyridoxine, and inositol, while thiamin showed a decrease in population of cells.

Quantitatively, no clear cut effects of the vitamins and their relation to the pyocyanin concentration and growth could be applied to the virulence of Ps. aeruginosa.

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AMINO ACID COMPOSITION OF HETEROTHALLIC ASCOMYCETE, GELASINOSPORA AUTOSTEIRA

(Publication No. 5933)

Daniel Paul Roman, Ph.D.
Michigan State College, 1952

The singly isolated ascospores of gelasinospora autosteira were assayed microbiologically for ten amino acids. The spores were grown on a uniform medium and treated as nearly alike as possible throughout the experiment. Prior to assay, fat was extracted and nitrogen determined. Gelasinospora

autosteira is heterothallic, consisting of two self-infestile strains, A and B. No conidia are produced and a culture containing only vegetative hyphae was obtained.

The results calculated to 16 percent nitrogen show no significant differences in the amino acid content of the cells.

Significant quantitative differences exist in the amino acid and protein content of the growth from singly isolated ascospores of gelasinospora autosteira when expressed as percent of dry weight.

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THE RELATIONSHIP OF SULFATHIAZOLE BACTERIOSTASIS TO THE FACTORS INVOLVED IN THE ACCUMULATION OF THE PURINE INTERMEDIARY, 4-AMINO-5-IMIDAZOLECARBOXAMIDE, IN ESCHERICHIA COLI, STRAIN B

(Publication No. 5624)

Richard Cummins Stewart, Ph.D.
University of Pennsylvania, 1953

Supervisor: M. G. Sevag

Sulfonamides are thought to interfere with the function of para-aminobenzoic acid or its conversion to a coenzyme involved in the biosynthesis of purines, which results in the accumulation of 4-amino-5-imidazolecarboxamide, or a derivative of this amine, and thereby contributes to, or causes the inhibition of bacterial growth. In regard to this postulate, our findings are:

(1) The carboxamide, or its derivative, accumulates during the normal growth of E. coli B. This organism, being a wild type, does not require purines, or other factors for growth, and thus is free from a block of any type postulated to be responsible for the accumulation of this purine intermediary. The accumulation is dependent on a carbon source such as glucose or l-arabinose, and can be increased by sulfathiazole bacteriostasis up to a maximum depending on the amount of glucose added (optimal amount 0.125% glucose).

(2) Aeration both at the start and during growth prevents the accumulation of the carboxamide, but does not destroy pre-formed carboxamide. This can be interpreted to indicate that the accumulation is related to an impairment of the aerobic and the promotion of anearobic metabolism, since under anaerobic conditions 40 per cent more carboxamide accumulates.

Comparable to the effect obtained during aeration, mono- and dicarboxylic acids (pyruvate, acetate, malate, succinate, citrate, α-ketoglutarate) related to the citric acid cycle, and malonate, inhibit the accumulation of the carboxamide, and also antagonize the inhibition of growth by sulfathiazole. The facts indicate an interrelationship between purine metabolism and these citric acid cycle intermediates.

(3) Both para-aminobenzoic acid and the citrovorum factor failed to prevent the accumulation of the amine in the presence or absence of sulfathiazole. Para-aminobenzoic acid antagonized, but the citrovorum factor failed to antagonize the inhibition of growth by sulfathiazole. These facts may permit the conclusion that PABA antagonism to sulfathiazole inhibition of growth and the metabolism of the purine intermediary are independent processes.

(4) This amine lacks carbon 2 for ring closure. Formate has been found in certain systems to provide carbons 2 and 8 of the purine molecule. It is known that formate can arise from glucose metabolism. The anaerobic metabolism of glucose, pyruvate and formate in Escherichia coli B was studied in the presence and absence of sulfathiazole using the Warburg respirometer. Glucose yields hydrogen via formate production accompanied by the subsequent action of the formic hydrogenlyase system. It was found that more hydrogen is evolved from glucose in the presence of sulfathiazole. This increase in hydrogen evolution is accompanied by a 30 per cent inhibition of glucose utilization. Therefore, the amount of glucose that is metabolized in the presence of the drug leads to more hydrogen production than do the drug-free controls. Using formate as substrate, the evolution of hydrogen was also accelerated up to 200 per cent in the presence of sulfathiazole.

These results would seem to indicate that the availability of formate from glucose metabolism for purine synthesis is influenced by sulfathiazole in that the drug facilitates the decomposition of formate into carbon dioxide and hydrogen, thus depriving the system of this needed metabolite.

An attempt is being made to relate these phenomena with the accumulation of 4-amino-5-imidazolecarboxamide, since formate is known to serve as the donor for carbons 2 and 8 of the completed molecule. However, the data obtained to date do not permit such hasty conclusions. This correlation may be more apparent than real, or merely a coincidence.

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BIOLOGY, GENETICS

CEREBRO-HEPATIC RELATIONSHIPS

(Publication No. 5522)

Ian A. Brown, Ph.D.
University of Minnesota, 1953

Hepatic failure is frequently accompanied by cerebral manifestations and the extent and severity of the latter is determined by the degree of liver damage. As yet the cause of cerebral involvement in hepatic disease remains unknown. In an attempt to shed some light on this a pathological survey of 42 cases of hepatic disease was undertaken. Although the underlying etiology of liver impairment was quite varied the cerebral lesions were quite stereotyped and manifest by alterations of neurones, myelin and glial elements. Changes in the cerebral neurones were in general mild and exhibited no characteristic features. The alterations of myelin were outstanding, widespread in distribution and composed largely of diffuse and perivascular areas without, however, any glial alterations in these areas. A somewhat more characteristic cerebral alteration is the astrocytic response with the production of the Alzheimer cell. Previous reports have emphasized this change as characteristic of hepatic disease but it was found in this series in but 54 percent of the cases examined. In addition it was found in a wide variety of other neurological conditions including tuberous sclerosis, senile states, cerebral degenerations and in the normal brain. When, however, such cells were present they appeared in large numbers particularly within the basal ganglia and cerebellar nuclei. The significance of these cells remains unknown.

Liver function studies in this group of cases correlated to some degree with the severity of the hepatic lesion. In all cases there was marked hyperbilirubinemia, elevated thymol turbidity, cephalin flocculation and serum globulin and cerebral involvement correlated more significantly to these tests than to any other hepatic function test. From this study of 42 cases of hepatic coma it was evident that while the brain was severely damaged in advanced hepatic disease a pathological evaluation revealed nothing than had already been described and it was reiterated that a pathological study per se can not and has not provided the answer to this intriguing relationship.

A clinical study was made on 40 patients with hepatic disease to determine the frequency with which the central nervous system is involved and to make a comparison between liver function studies with and without coma. Again as in the previous group the hepatic pathology was quite diverse. Neurological symptoms embracing alterations of reflexes, cranial nerves, muscle strength sensation and coordination were observed in 67 percent of the cases examined. No trends in liver function studies were noted that would indicate that coma was impending. In general the non coma group had lower serum bilirubin, cephalin flocculation, thymol turbidity and serum globulin values than the group with coma. Electroencephalography was done in a small percentage of cases and although abnormal in cases with coma the abnormality was not considered specific.

Investigation of cerebral changes in experimental hepatic damage induced by necrogenic and choline deficient diets in rats showed no significant alterations of glia, neurones or myelin. Fat stains showed some cerebral vessel embolisation. Irregular areas following fiber tracts in most instances and more marked in the cerebellum and brain stem were noted which exhibited fluorescence under ultra violet light similar to that of porphyrins.

No specific conclusions were possible in this evaluation and the study was concluded by a discussion of some factors which may be instrumental in the production of the cerebral changes including aberrations in the metabolism of copper, iron, amino acids, porphyrins, carbohydrates, lipids, vitamines and cellular enzymes.

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RELATIVE VIABILITY OF ALBINO AND NORMAL PARADISE FISH, MACROPODUS OPERCULARIS, WHEN EXPOSED IN THE LABORATORY TO VARIOUS MORTALITY-PRODUCING AGENTS

(Publication No. 5652)

Philip Jason Clark, Ph.D.
University of Michigan, 1953

The relative viability of newly hatched albino and heterozygous paradise fish was investigated. Viability was measured by the proportion of organisms which lived when a group of them was exposed to a specified environmental condition for a specified period of time. When subjected to high temperatures, suffocation, and certain concentrations of hydrochloric acid and sulfuric acid, as well as under ordinary aquarium conditions, individuals heterozygous for albinism were more viable than those homozygous for the recessive trait. On the other hand, individuals homozygous for albinism were more viable than the heterozygotes under low temperatures and with certain concentrations of potassium hydroxide and ammonium hydroxide. When subjected to gamma radiation, high salinity (sodium chloride) and certain

concentrations of acetic acid, the two genotypes did not differ significantly in viability. The effects of differences in vision between the two genotypes are believed to have been eliminated in these experiments.

The action of the albino gene in producing increased adaptation to certain environmental complexes has considerable evolutionary interest in suggesting how a gene through its physiological effects may adapt an organism to a specific environment, even though the morphological manifestation of the gene has no apparent direct relationship to any feature of that environment.

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EFFECTIVENESS OF INDIVIDUAL PLANT SELECTION IN ZEA MAYS L FOR RESISTANCE TO THE EUROPEAN CORN BORER (PYRAUSTA NUBILALIS HBN)

(Publication No. 5544)

Frank Albert Loeffel, Ph.D.
University of Minnesota, 1953

The primary objectives were to determine the effectiveness of individual plant selection for corn borer resistance in segregating generations of single crosses and the relationship of this selection to other agronomic characters. The value of visually rating individual plants for corn borer injury and the effect of infesting inbred lines at different stages of plant growth were also investigated.

Parents, F_2 plants, and selected F_3 lines were grown from each of the three crosses studied; A158 x B2, A15 x 41-2504B, and A165 x 42-645. Selected F_4 lines and F_1 plants of the A158 x B2 cross were also grown. A158, A15 and A165 are early maturing inbreds. These lines show little leaf feeding injury, but are highly susceptible to damage point injury when infested with corn borer egg masses. B2 is a later maturing line which is susceptible to leaf feeding, but has moderate resistance to midrib, sheath, and stalk feeding. Lines 41-2504B and 42-645 are extremely late South American lines which are resistant.

Each plant was infested manually with corn borer egg masses. Individual plants were classified for leaf feeding injury, damage point injury, date of first pollen shed, and stalk breakage. A complete randomized block experiment was used for individual crosses.

Individual plant selection for corn borer resistance in the F_2 generation was effective in isolating the more resistant genotypes as measured by F_2 plant progeny tests. F_2 plant-F_3 line inter-annual regression coefficients for leaf feeding injury were +.16, +.40, and +.18 in the crosses A158 x B2, A15 x 41-2504B, and A165 x 42-645. Regression coefficients of +.21, +.42, and +.31 were obtained for the association between F_2 plant and F_3 line ratings for damage point injury in the previously enumerated crosses. All coefficients are significant at the 1% probability level.

The comparative value of selection of individual plants in the F_2 and F_3 generations for resistance to corn borer feeding injury was shown by the performance of F_4 lines in the cross A158 x B2. Selection for resistance to leaf feeding injury was more effective in the F_2 generation than in the F_3 generation. Equal gains were made by selection in the F_2 and F_3 generations for resistance to damage point injury. When the range of plant maturity is not too great, leaf feeding is an effective criterion for screening a population for resistance to corn borer. This is shown by the within generation leaf feeding-damage point rating correlation coefficients of +.53 and +.70 in the F_2 and F_3 generations, respectively, in the A158 x B2 cross.

Selection for resistance to corn borer did not adversely affect the distribution of other agronomically desirable plant characters.

The accuracy of visual plant ratings to measure corn borer injury of individual plants was studied in relation to the number of live borers, borer entrances, and borer tunnels in the same plants. Data indicate that breeding material may be evaluated for corn borer resistance quickly and accurately on an individual plant basis by use of visual injury ratings.

Feeding injury on early maturing dent corn inbreds was shown to differ when infested at different stages of plant growth. Leaf feeding injury was most severe when the plants were infested at a less advanced stage of development. A complete reversal of this trend was indicated for damage point injury.

It is suggested that plant resistance be evaluated under conditions of manual infestation. The application of egg masses should coincide with the natural period of oviposition by the female moth since the resistance mechanism, to be effective under field conditions, must be operative at this time.

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EAR DEVELOPMENT AND OTHER CHARACTERISTICS OF SELECTED STRAINS OF MAIZE AS AFFECTED BY EUROPEAN CORN BORER

(Publication No. 5549)

Lakshmi Singh Negi, Ph.D.
University of Minnesota, 1953

The investigation was designed to determine (i) the relative tolerance of selected inbred lines of maize to corn borer Pyrausta nubilalis and their ability to transmit this tolerance to their hybrid progeny and (ii) the relationship of the tolerance reaction and other types of borer feeding reactions with agronomic characters.

Twelve inbred lines and 49 single crosses were

grown in separate duplicated randomized replicated blocks in single row plots. In these plantings the first five plants in each row were manually infested with 4-5 borer egg masses per plant or inoculated with Diplodia and Gibberella infested tooth picks. Visual ratings in classes 1 (resistant) to 5 (susceptible) were given to each individual infested plant for leaf feeding, damage point and ear development reactions and to each inoculated plant for stalk rot reaction.

Ear development reaction of the inbred lines, which were under observation for two years at two locations was quite consistent. There were significant differences between the strains allowing the inbreds to be classified into three groups, vis., R (tolerant), I (intermediate) and S (susceptible). Although the ear development of the crosses was much less adversely affected by borer than that of the inbreds, there was a significant relationship between the reaction of the inbred parents and their hybrid progeny, r = +0.539. The mean ear development ratings of the crosses showed a progressive and significant increase from the R x R (1.60) to the S x S group (2.04).

Leaf feeding and damage point reactions of the inbred lines appeared to be comparatively less consistent than ear development reaction but inter-annual and inter-station associations for these ratings were still high. Leaf feeding reaction did not show significant relationship with ear development but there was significant relationship between leaf feeding and damage point reactions and also between damage point and ear development reactions. Leaf feeding reaction did not show any significant relationship whereas damage point and ear development reactions showed significant and more or less, identical relationship with most of the agronomic characters. In partial correlations where variations due to maturity differences were eliminated, only ear development reaction exhibited significant association with loss in yield (r = +0.328).

Yield, number of good ears per plant, ear length, per cent ear moisture at harvest and per cent smut showed a significant decrease and stalk breakage a significant increase in the infested plots. Infested plots silked slightly earlier than non-infested. Except for yield, and to some extent for stalk breakage, the decrease or increase in values of various characters in the infested plots were not associated with ear development reaction.

The over-all decrease in yield from borer injury was 15.9 to 40.2% for inbreds and 4.96% or 5.15 bu. per acre for crosses. The R lines and R x R crosses, suffered less loss and S lines and S x S crosses suffered greater loss in yield. The average loss in R x R crosses was 3.15 bu. per acre (2.89%) as against 8.15 bu. per acre (9.96%) in S x S crosses.

Significant differences were observed in the reaction of inbreds and crosses to the two stalk rotting organisms, but there was some indication that this reaction is greatly influenced by environmental factors. Ratings for ear development and damage points gave significant r values for association with ratings for stalk rot caused by the two organisms.

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SOME FACTORS AFFECTING DELAYED SEPARATION OF CONJUGANTS IN PARAMECIUM AURELIA[1]

(Publication No. 5886)

Henderson Kingsberry Wood, Ph.D.
Indiana University, 1953

Conjugating mates in Paramecium aurelia usually fall apart quickly at the conclusion of the mating process, but the separation may sometimes be delayed at one or the other or at both of the two regions of contact between the two conjugants. As the occurrence and extent of cytoplasmic exchange between the mates had been found to be directly correlated with the extent of delayed separation at one of the points of contact (paroral region), the delayed separation phenomenon has assumed a prominent role in recent investigations dealing with cytoplasmic inheritance. Since this condition is normally of infrequent occurence, a reliable means of assuring cytoplasmic exchange without otherwise interfering with the cytogenetic processes would facilitate genetic work with this animal. One of the primary aims of this investigation is the experimental control of delayed disjunction. The failure of fused protozoan mates to separate may be viewed also as a special example of the failure of cells to separate in general (i.e., metazoan cells in early development). It was therefore hoped that the discovery of factors involved in delayed separation of conjugants in Paramecium aurelia might be of general value, even if only suggestive, in relation to the more general problems of cytokinesis and the maintenance of cell aggregation during development in higher organisms. A brief description of each of the factors found to affect separation time follows.

In determining the effect of time since last feeding, it was found that separation time increased somewhat as time since feeding increased, and that the longest separation times occurred 32 hours following feeding.

The effect of temperature was next tested, and it was found that the extreme temperatures of 4° C. and 39° C. during the latter part of the conjugation period markedly extended the separation time, while the intermediate ones showed no effect. Further, separation time increased with the length of the exposures to both the high and low temperatures.

The effect of a modified 50 per cent Ringer's solution on separation time was to prolong the separation time beyond the mean for culture fluid.

The age of the culture, as determined by the time since the last fertilization (i.e., autogamy or conjugation), was found to be important in affecting the extent of separation time, the longest separation times being restricted to the first 3 days.

A cumulative effect was indicated when all of the

above factors were combined at their optimum with the combination at 4° C. exerting the greater influence on separation time.

Genetic and cytologic tests were made to determine if the above combined optimal conditions at 4° C. would result in abnormal nuclear behavior. Results of the experiments indicated that normal meiosis, fertilization and nuclear reorganization generally occurred, abnormal behavior being found in only about 5 per cent of the conjugants. The technique for securing extended delayed separations was thus found to be a practicable one.

As a result of breeding analysis following crosses between stock 51, a delayed separation stock, and stock 32, a non-delay stock, it was shown that the appearance of delayed separations under the usual culturing conditions is dependent upon a recessive gene, ds.

The results obtained are consistent with the following hypothesis. The gene ds controls an enzyme involved in gelation of the cortex of the localized region of the cell where mates unite in fertilization. Gelation is also favored by salt solutions, while solation is favored by extreme temperatures. Final separation of mates is due to mechanical snapping of the gelated connective between them.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Dr. T. M. Sonneborn whose constant advice and encouragement made this work possible. Thanks are also extended to Dr. Fernandus Payne, Dr. T. W. Torrey, Dr. R. E. Cleland, Dr. W. J. van Wagtendonk, Dr. H. J. Muller, and Dr. W. R. Breneman, who, as members of his Advisory Committee, willingly gave their assistance. As a General Education Board Predoctoral Fellow, the author would also like to acknowledge his indebtedness to them.

1. An Abstract of a Dissertation submitted to the Faculty of the Graduate School in partial fulfillment of the requirements for the Degree, Doctor of Philosophy, in the Department of Zoology, Indiana University, June, 1953.

Microfilm copy of complete manuscript of 94 pages, $1.18. Enlargements 6" x 8", 10¢ per page Library of Congress card number MicA53-1037.

BOTANY

BIOSYSTEMATIC STUDIES IN THE GENUS ASTER

(Publication No. 5854)

Charlotte Jo Avers, Ph.D.
Indiana University, 1953

Ten species in the genus Aster, section EUASTER, were investigated in a biosystematic survey. Chromosome counts indicated a diploid-tetraploid-octaploid series based upon the haploid complement of 9. Eight of these species were used in artificial hybridizations and their interfertility relations were determined. The experimental investigations were supplemented by herbarium studies and analyses of introgression in natural populations.

Experimental crossings between diploid species resulted in partially fertile F_1 hybrids while those between tetraploid species yielded F_1 hybrids which were completely pollen-fertile. In all the crosses but two, the number of seeds produced in the initial interspecific hybridizations was less than 25 per cent of the potential seed set. This feature was discussed in relation to early zygotic elimination as a consequence of genic unbalance and as a possible factor in reproductive isolation. In two tetraploid crosses there was reduction of fertility or vigor, or both, in the F_2 and first backcross generations procured. This is believed to indicate cryptic structural hybridity, or, genic differentiation. Some gross structural differentiation was apparent from the presence of unpaired chromosomes in diploid and tetraploid hybrids. This differentiation is correlated with pollen fertility in diploid hybrids, but is not effective in tetraploids where there is extensive duplication of chromosome material.

Studies of material from herbaria and from natural populations indicated that specific boundaries were not disrupted despite the presence of occasional fertile hybrid derivatives. It was suggested that several factors in conjunction with one another prevented species amalgamation. The most effective factors limiting gene exchange between species populations are: polyploidy, ecological isolation, lethality of hybrid zygotes leading to reduced seed set in interspecific crosses, predominance of backcrossing, hybrid sterility, and inviability of later hybrid generations. Although few single factors are sufficiently restrictive to extensive gene flow between species, a combination of several isolating mechanisms may have an additive effect in this respect.

This group of species exhibits varying degrees of convergence and divergence which is a possible indication of a rapidly-evolving species complex. The presence of autotetraploids and segmental allotetraploids, in addition to the diploid species, has resulted in a reticulation of the phylogenetic pattern. It was suggested that interbreeding at the tetraploid level resulted in a chain of intermediates which increased the complexity of species pattern and variation in this group, and partially obscured definitive species boundaries. However, a complete taxonomic revision of the HETERO-PHYLLI cannot

be attempted until the biological status of the various taxa has been established. One species, Aster azureus, was reduced to subspecific rank under A. shortii on the basis of experimental evidence. To further change the concepts of this species-group, on the basis of limited data, would obscure our present understanding. The application of the ecotype concept was discussed in relation to the nature of species in this group and it was found that preliminary data concerning morphological, ecological, and genetic divergence did not allow the use of the ecotype-ecospecies units in this group. Some theoretical concepts were proposed in relation to phylogeny of those species in which polyploidy was a prominant factor.

Further experimentation and synthesis were suggested to attack the problems concerning phylogeny of the HETERO-PHYLLI. Until such time, however, this group is considered to be composed of nine closely related species represented by diploid, autoploid, segmental alloploid, and true alloploid entities.

Microfilm copy of complete manuscript of 156 pages, $1.95. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1038.

THE ECOLOGY OF ALGAE GROWING IN THE SALINE RIVER, MICHIGAN, WITH SPECIAL REFERENCE TO WATER POLLUTION

(Publication No. 5640)

John Leo Blum, Ph.D.
University of Michigan, 1953

The algal vegetation of the Saline River was studied throughout a period of twelve months in 1952-53 as to (1) its composition, (2) periodicity of the principal species, (3) succession, and (4) environmental conditions influencing the algae. The upper course of the river is unpolluted and mildly alkaline, has a high bicarbonate content, usually abundant nutrients, and has an algal vegetation which included Cladophora glomerata in spring, Diatoma vulgare and Gomphonema olivaceum in winter, and a calcified Phormidium-Schizothrix community which is present throughout the year.

The lower course of the river is influenced by industrial wastes and sewage entering the river principally at Saline and Milan. Below the industrial outfall at Saline, the water contains chromium, copper, and cyanide ions, and the flora of the upper course disappears almost completely, being replaced by a luxuriant flora of Stigeoclonium tenue and other species. Below the domestic outfall at Saline, the summer riffle vegetation is dominated by the bacterium Sphaerotilus and the diatom Nitzschia palea; at other seasons Stigeclonium tenue, Tetraspora cylindrica, and Navicula seminuloides are present on riffles, whereas the pools are dominated by Spirogyra spp.

Analyses for important nutrients were made by colorimetric methods at approximately ten-day intervals. Inorganic phosphates, moderately low to low in the upper course of the stream, increase sharply below the Saline outfalls and remain relatively high for most of the remainder of the stream. They are uniformly low in winter at all stations and are, by contrast, relatively high throughout the other seasons. Nitrates increase markedly in amount in the lower course of the stream. They are more abundant in the cold months than in the warm months. Organic nitrogen is generally plentiful throughout the stream's course. It increases sharply in amount below the Saline outfalls and remains relatively high.

Algal periodicity was investigated by transect studies and by dry weight determinations. Certain evident changes in algal growth were synchronous with certain marked environmental changes. The rise to dominance of the principal algal vegetations of summer, as well as their subsequent disappearance, both occurred when not one but many profound changes were taking place in atmospheric as well as other physico-chemical factors. The presence of more than one variable thus renders inconclusive any generalization expressing a relationship of algal growth to environmental condition.

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THE RELATION OF PLANT GROWTH HORMONES TO PHOTOPERIODISM

(Publication No. 5656)

Anson Richard Cooke, Ph.D.
University of Michigan, 1953

The purpose of this study has been to determine if a change in auxin concentration is associated with flower initiation in plants responding to photoperiodic treatment and if this is so, is this change in auxin the cause of flower initiation.

In the first part of the study, the auxin content of several species of plants, as measured by the standard Avena method, was followed during the photoinduction period. In these experiments it was discovered that there is a decrease in auxin content in both long-day and short-day plants associated with the appearance of flower primordia. This decrease occurs regardless of the method of induction. If Xanthium plants are induced for only 3 days or if only a single leaf is used in induction, there is still a decrease in auxin accompanying the appearance of flower primordia. However, the auxin change for the first few days following the start of induction is quite variable. In a series of experiments it was shown that if a plant was suddenly changed from long days to short days there is an increase in auxin content for the first few days. Likewise, a plant suddenly changed from short days to long days generally has a decrease in auxin content for the next few days. However, these changes in auxin content are associated

with the sudden change in photoperiod and not with any photoinduction process. After the plants have come into flower, their auxin content depends upon the photoperiod under which they are growing. It was shown that plants growing under long days, whether they are flowering or vegetative, contain more auxin than plants growing under short days.

In the second part of this study an attempt was made to induce flowering by lowering the auxin content of the plant. It was shown that decapitation lowers the auxin content but this has no effect on the initiation of flower primodia. Likewise, continuous gamma irradiation lowers the auxin content of plants but in general, has no effect on flower initiation. High dosages of gamma irradiation that stunt the plant also suppress flower initiation. The plants receiving these high dosages of irradiation contained more auxin than the plants receiving lower dosages. However, high dosages of gamma irradiation hasten the flowering of Nicotiana rustica, var. Olsen 68. Treatment with antiauxins hastens the flowering response in Biloxi soybeans but will not bring about flower initiation under unfavorable photoperiods. Treatment of long-day plants with antiauxins may decrease the flowering response of these plants. In general, lowering the auxin content will not bring about flower initiation under unfavorable photoperiods.

It may be concluded from these experiments that flower initiation in both long-day and short-day plants is associated with a decrease in auxin content. However, this decrease in auxin is not in itself the cause of flower initiation, as lowering the auxin content of the plant by various methods has not brought about flower initiation under unfavorable photoperiods.

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THE SYNTHESIS OF NICOTINIC ACID IN LEAVES OF TOMATO, LYCOPERSICUM ESCULENTUM MILL.

(Publication No. 5658)

Frederick Loring Crane, Ph.D.
University of Michigan, 1953

The purpose of this investigation was to determine the factors which affect the biosynthesis of nicotinic acid in the leaves of a mature green plant in order to discover how the process is related to the pathways of nicotinic acid synthesis established for certain animals and microorganisms.

A leaf disk technique was used (1) to isolate the nicotinic acid metabolism of the leaf from that of the rest of the plant, and (2) to provide equal samples of leaf tissue in which the nicotinic acid content could be determined before and after exposure to the experimental conditions. Proposed precursors and related compounds were brought in closer contact with the leaf cells by low pressure infiltration of the tissue with solutions of the compound under consideration.

Leaf disks increase in nicotinic acid content when incubated in light, but no increase occurs in darkness. This increase in light is not caused by the wounding inherent in disk cutting. The light activation is not caused by photosynthesis as demonstrated by the fact that a light intensity of twenty five foot-candles is as effective as higher intensities. Furthermore, the system leading to nicotinic acid accumulation is destroyed by boiling, and the effect of temperature on the reaction rate indicates that thermal as well as photochemical reactions are involved.

dl-Tryptophan, l-tryptophan, and 3-hydroxyanthranilic acid, which have been identified as nicotinic acid precursors in other organisms, do not increase the rate of synthesis in light, nor do they cause synthesis to occur in the dark. Penetration of dl-tryptophan into the cells is indicated by auxin synthesis in disks to which it has been added.

Light starvation reduces the ability of leaf tissue to synthesize nicotinic acid on subsequent exposure of disks to light; and the precursors mentioned above, as well as sucrose, do not restore the synthetic potential.

Although the leaves of zinc deficient plants have a lower tryptophan content than plants grown on complete nutrient supply, the leaves of both groups of plants have the same nicotinic acid content, and leaf disks from both groups increase in nicotinic acid content at the same rate. Added tryptophan does not increase, and often decreases, nicotinic acid synthesis in leaf disks from zinc deficient plants.

It was concluded that there is a light activated system whereby nicotinic acid is synthesized in leaves, and that this system is not directly related to photosynthesis. It was further proposed that this system constitutes an alternative pathway of nicotinic acid synthesis in which tryptophan is not involved.

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TROPICAL SOIL FUNGI

(Publication No. 5465)

Wendall Moore Farrow, Ph.D.
State University of Iowa, 1953

A total of 31 samples collected from varied soils in Panama and Costa Rica were examined for their mycobiota. Because of the larger number of collections from Barro Colorado Island, probably the common soil inhabiting fungi were isolated, but the smaller number of collections from the remaining five areas would be less indicative of the prevalent fungi.

17 nutrient media were screened and several selected which could be used consistently since they supported the growth of a wide range of fungi and restricted the growth of most fast-spreaders. The ones most suitable were IIa rose bengal streptomycin agar, non-carbon solution agar in combination with amino acids or growth substances, plain agar, dahlia dextrose agar and hemp seed agar. The addition of

plant tissues, of corn, Desmodium or Phelum to the media increased the number of species isolated. The same species were often isolated on more than one substrate, but this overlapping was not complete enough to warrant omitting any of the selected media.

A total of 141 species representing 78 genera were isolated. This number was divided into the following groups:

Actinomycetes	2
Myxomycetes	3
Phycomycetes	11
Ascomycetes	20
Fungi Imperfecti	105

The more common genera isolated were Penicillium, Aspergillus, Fusarium, Cunninghamella, Trichoderma, Absidia, Chaetomium, Acrostalagmus, and Gliocladium. Species of Aspergillus and Chaetomium seem to be more common in tropical soils than in those of temperate climates. The Mucorales are apparently uncommon in tropical soils, whereas their occurrence in cooler climates is usually widespread.

Several unusual fungi were isolated which have been reported infrequently from the soil. These are: Aspergillus chevalieri, Aspergillus fonsecaeus, Aspergillus ochraceus, Aspergillus unguis, Blakeslea trispora, Choanephora conjuncta, Coemansia reversa, Heterocephalum aurantiacum, Masoniella grisea, Penicillium rubrum, Patouillardiella sp. and Saksenaea vasiformis.

The direct multi-point inoculation method was practical when weak media were used since they limited the growth of the rapid-growing fungi. This restricted growth made possible the detection and isolation of minute colonies which, on a richer medium, would have been overgrown by other organisms.

Two water-mounting media were tested with a number of fungi. Both media were acceptable since plasmolysis was observed in only a small percentage of the total. However, the medium proposed by Thirumalachar was more satisfactory because less time was needed to prepare a mount. The medium devised by Ellis is time-consuming and a satisfactory mount depends on securing a thin cellulose acetate film of the object.

Several species of Aspergillus and Penicillium inhibited the growth of Staphylococcus aureus but not of Candida albicans.

84 fungi were drawn or photographed. This number included most of the unusual organisms and some of the common types.

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AN ECOLOGICAL ANALYSIS OF THE ISOLATED PRAIRIES OF NEWAYGO COUNTY, MICHIGAN

(Publication No. 5920)

Richard Scott Hauser, Ph.D.
Michigan State College, 1953

Within the limits of four townships in Newaygo County, Michigan, there occurs a group of prairies completely surrounded by forest vegetation, and separated by about 65 miles from the nearest prairies in the southwestern part of Michigan.

The present study has two main objectives. The first is to consider the prairies of Newaygo County in detail with respect to their floristic and ecological characteristics. The second is to consider the factors related to the isolated occurrence of these prairies and to formulate an hypothesis to account for their original occurrence and subsequent persistence within a forest region.

The area is described in detail with respect to its physical features, its history, and the nature of the prairies which occur within it.

The vegetation of the Newaygo prairies is considered from the standpoint of the concept of frequency, interpreting the individual prairie areas as fragments of a large natural stand. Frequency is discussed in terms of 1-square-meter quadrats and 100-square-meter plots. A rapid method for locating ten quadrats within a plot is described. The dominance of the various species in the community is determined on the basis of the amount of ground covered, and is evaluated by means of a "cover index."

Relationships between these prairies and their surroundings are investigated and discussed, and their connections with the main body of the prairie peninsula are noted. It has been concluded that the Newaygo prairies, in spite of their isolation, have definite affinities with the prairie peninsula.

Various factors which may be related to the isolation of the Newaygo prairies have been considered. These include climatic, edaphic, biotic, pyric, and anthropeic factors. It is held that the prairie vegetation invaded the forests during a postglacial warm and dry period. Subsequently, as the climate became cooler and more humid, the trees reinvaded the area, surrounding and isolating the prairies of Newaygo county. The persistence of these prairies within the forest cannot be explained by any one factor. It is due, rather, to a delicate balance between many phases of the environment.

It is noted that afforestation activities now in progress threaten to eliminate the prairies completely from Newaygo County.

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DESCRIPTION OF THE PLANT COMMUNITIES AND ENVIRONMENTS OF THE CRESTED BUTTE AREA, GUNNISON COUNTY, COLORADO

(Publication No. 5543)

Jean Harmon Langenheim, Ph.D.
University of Minnesota, 1953

A plant-ecological reconnaissance was made in the Crested Butte Area, between 8,500 and 13,500 feet on the southwest flanks of the Elk Range in west-central Colorado. Distribution of the vegetation was mapped by aerial photographs and Brunton compass. Community composition was studied by means of paced transects and list quadrats. A reference collection of species authenticates the vegetation study. Coincidence of plant communities with altitude, parent materials, and exposure was analysed by overlaying maps of these factors on the vegetation map and determining coincident areas by a grid system. A simple ratio system was devised to quantitatively express the importance of these various factors (Coincidence Index).

Five vegetation zones are recognized: sagebrush, aspen, spruce-fir, upland herb, and alpine. The sagebrush zone dominates the 8,500-9,500 foot altitudinal range, and extends downward to 7,500 feet in adjacent areas. Artemisia tridentata is dominant with Festuca Thurberi the most prominent subordinate.

Reference to the aspen community here only implies the presence of Populus tremuloides. It occurs from 8,500 to 11,200 feet, but forms an altitudinally defined belt between 9,500 and 10,500 feet. Some aspen replaces burned forest and is successional. Most of the community here, however, shows little evidence of replacement by another community. There are four common undergrowth types. Mature undergrowth occurs where groves have been long established. Where aspen is invading fescue and sagebrush communities there is an ecotonal undergrowth. Characteristic undergrowth also occurs on talus.

The spruce-fir community is most extensive, occurring from 8,500 to 12,500 feet and forming a definite zone from approximately 10,500 to 11,500 feet. Picea engelmannii and Abies lasiocarpa are the tree dominants. Lodgepole pine, aspen, and burn grassland communities replace burned spruce-fir forest, with the grassland being the most widespread.

The upland herb community is characteristic of non-forested areas from approximately 10,500 to 12,500 feet. It is composed of a large number of forbs and grasses. It appears relatively stable and distinct in both flora and physiognomy, and therefore is considered zonal. Distribution of the high-altitude willow community closely parallels the upland herb community, but occupies far less area.

The alpine zone reaches optimum development from 12,500 to 13,500 feet, although alpine species occur at lower elevations. "Communities" consist of characteristic groups of species, but "dominance" varies from stand to stand on fell fields, boulder fields, and on talus. Successional lines have not been discerned. Aretes provide most of the area available here to alpine species; a matrix vegetation type occurs on fell fields which develop here.

The fescue grassland, Douglas fir-limber pine, and hydric communities are considered interzonal. The Festuca thurberi grassland occurs mainly as islands within all zones from 8,500 to 12,500 feet. It appears to be an edaphic climax in some areas, but is being invaded by aspen in others. Douglas fir and limber pine occur in small patches from 8,500 to 10,500 feet, usually on steep southeast-facing slopes. The hydric group includes wet meadow, streamside, and snowflush communities, occuring from 8,500 to 13,500 feet. Composition varies with elevation.

The vegetation in the Crested Butte Area is compared with described areas throughout the Rocky Mountains and Great Basin. The vegetation appears more closely allied with central Utah than the eastern slope of the Colorado Rockies. Zonal sequence, however, appears to be in response to more xeric conditions than those producing the "normal" sequence both on the eastern slope and in other localities on the western slope of the Rockies and in the Great Basin. Correlation of this vegetational pattern with the steep precipitational gradient and extreme amount of southwest exposure is strongly suggested.

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STUDIES OF THE PARASITISM OF CERCOSPORA ARACHIDICOLA HORI AND CERCOSPORA PERSONATA (B. & C.) ELL. & EV.

(Publication No. 5548)

Lawrence Ingram Miller, Ph.D.
University of Minnesota, 1953

A survey conducted in 1947, in ten Southern States, showed that C. arachidicola was more prevalent than C. personata. Six hundred and ninety-seven isolates were obtained in culture. Five of the isolates were of C. personata; these were culturally different and of the conidial type. The other isolates were of C. arachidicola and 122 were culturally different; of these, 80 per cent were of the conidial type, 15 per cent of the conidial-mycelial type, and 5 per cent of the mycelial type. The conidial cultural types were the most pathogenic. C. arachidicola was the more pathogenic and successful species.

Races of C. arachidicola and C. personata may be isolated from the same lesion, and different races of C. arachidicola may infect the same plant, the same leaflet, and also may be found in the same lesion. No race exerted antibiotic action against any other race of either its own or the other species.

Since mutation occurs in culture, it probably is responsible for the formation of many of the different

races. Ascospores were produced in one pure culture of C. arachidicola.

The temperature range for the growth of three races of C. arachidicola was from 2° C to 35° C., with an optimum range of 25° C. to 32° C. The temperature range for growth of three races of C. personata was from 4° C to 34° C., with an optimum range for growth from 25° C. to 30° C. Of the races tested, those of C. arachidicola made a more rapid rate of growth than those of C. personata. Race 1a of C. arachidicola formed conidia in culture, produced leaf infection, allowed lesion development, and caused leaf shedding over a wider range of temperature and at a higher optimum temperature, than race 1p of C. personata. Cultures of races 1a and 1p grew in media with a pH from 3.0 to 8.5., and both races were able to utilize glucose, sucrose, maltose, inulin, and starch as a source of carbon. The survival of these fungi in culture is threatened above 37.5° C. Race 1a withstood the cold better than race 1p. Race 1a was also pathogenic to leaflets of a wider age range than race 1p.

The leafspot fungi may be disseminated by splashing rain water, and on infested seed pods, soil, and peanut-vine hay.

The leafspot fungi do not form spores and spore germination does not occur unless conditions are very humid.

The Spanish 146 variety is a good differential variety for testing pathogenicity of various biotypes of the peanut leafspot fungi. There appears to be a relation between the lesion infection type of this variety and the pathogenic capabilities of the biotype.

When tenperatures are favorable for leaf shedding of infected leaves, the larger the infected area, the sooner leaf shedding will follow. Lesions will, however, increase in size below the minimum temperature at which leaf shedding occurs.

The amount of leafspot is relatively less when vine growth is too heavy for maximum yields of nuts. Under certain conditions nodulation, supply of nutrients, and injury from insects and nematode pests affect the relative resistance rating of plants to leafspot. Varieties resistant to the leafspot disease have a longer growing period than susceptible varieties.

Of 113 erect-growth varieties compared, P. I. 153342 was the most resistant and P. I. 161316 the most susceptible to C. arachidicola infections. Of 49 prostrate varieties compared, P. I. 149637 was the most resistant, and Va. RJS the most susceptible.

In a study of ten peanut varieties of varying resistance of C. arachidicola, the varieties with seed of the highest riboflavin content were relatively more resistant.

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THE TAXONOMY AND ECOLOGY OF THE FLORA OF THE SAN FRANCISCO WATERSHED RESERVE

(Publication No. 5809)

George Thomas Oberlander, Ph.D.
Stanford University, 1953

Much of the vegetation of the San Francisco Watershed Reserve, located on the San Francisco Peninsula, has remained relatively free from outside disturbances since the time of the early pioneers. The area studied occupies twenty-two square miles and is covered with a pattern of vegetation types which are remarkably distinct. There is considerable diversity of environment even within a range of several miles. Heavy summer precipitation of fog in one section may be contrasted with sunny, almost desert-like conditions a few miles away. Annual rainfall may vary more than fifteen inches from one section to another. Temperature is comparatively mild throughout the year. The area is a complex geological zone along the San Andreas Fault. The soils almost alwa;s give an acid reaction even near large exposures of serpentine and limestone outcroppings.

This study was undertaken in an attempt to analyze the vegetation types with respect to the physical factors of their environment and their floral content, and to relate these findings to traditional concepts of vegetational classification, succession, and climax. During three seasons 563 species and subspecies were collected and related in the spread of their populations to the physiognomic pattern of twelve conspicuous vegetation types. These types represent fairly stable plant aggregations which correspond to phytosociological units. An analysis of each vegetation type revealed low fidelity of secondary species to any one type; most species were distributed through the areas covered by several types. There was notable discontinuity among the understory populations, and there was considerable fluctuation in the annual populations from year to year. Only the species population itself appeared to have any functional unity such as manifested by genetic relationships between interbreeding species.

Succession is evident in much of the area, particularly where there has been local disturbance such as fire or clearing. Alien species are most numerous in the disturbed zones and planted species often serve as nuclei for new successions. Events which for a short time facilitate the germination of a species may have an effect in determining the sequence of succession and ultimately the vegetation type. Each species expresses climatic stability directly in terms of its pool of tolerances of the dynamic factors of environment by expanding or shrinking in population size. The application of the concept of climax to aggregations of species implies an ultimate static relationship among the elements and fails to emphasize the dynamic aspects.

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THE OAK UPLAND CONTINUUM IN SOUTHERN MICHIGAN

(Publication No. 5930)

George Wyman Parmelee, Ph.D.
Michigan State College, 1953

Although oak upland forest occupies more aggregate acreage than any other natural community in southern Michigan (Gysel and Arend 1953), this element currently ranks as the least known plant community of the region. Accordingly, a primary objective of this study has been to record by phytosociological methods the vascular components of a regional series of stands representative of the oak upland type. In all, quadrat data for trees, shrubs and herbs from 36 stands distributed through 17 countries are presented.

The extremely diverse species representation indicated by these data suggested that the continuum concept as elaborated by Curtis and McIntosh (1951) would provide the most realistic orientation of stands for purposes of comparison and contrast. Importance values were therefore computed for each tree species and these values were weighted by climax adaptation numbers to yield continuum index numbers ranging from 751 to 1999.

Data representing individual components of the various synusiae of each stand were charted in a sequence determined by these continuum index numbers. The resulting curves were interpreted as graphical expressions of tolerance ranges. No tendency for such ranges to occur in patterns suggesting discrete combinations of species was evident in any synusia. Rather, the charts based on tree data indicated that even the most contrasting stands differed less by kind of dominants than by proportion of dominants. The majority of shrub and herb species were found to show definite correlation with continuum index sequence. Among those which do not are certain of the more ubiquitous subdominants and those which occur so sporadically that trends are inconclusive. Species of either of these categories are held to have no utility as indicators of site.

The leading pairs and trios of dominants in each stand were correlated with continuum index sequence in order to determine the validity of each as bases for empirical classification of oak upland stands. For this purpose two leading dominants are held to be superior to three because of the fewer number of unduplicated combinations and the narrower overlapping in scale position of the stand groupings characterized by the same leading dominants. The scale sector between index values of 1350 and 1400 was tentatively recognized as a boundary separating stands having black oak as one of the two leading dominants from those in which red oak has a similar position.

Few "natural laboratories" of the type envisioned by Major (1951), in which the influence of one-factor environmental variation on continuum index number could be noted, were found. Stands developed on slopes of southern exposure had significantly lower continuum index numbers than those developed on slopes of northern aspect. Except on north slopes, severe disturbance was likewise reflected by a significant lowering in continuum index number. Despite effective variation of other environmental factors, a general correlation was noted between continuum index number and soil texture.

Data obtained in this study were combined with information from other sources in an effort to test the validity of the various climax hypotheses as applied to the oak upland continuum in southern Michigan. The climax pattern hypothesis of Whittaker (1953) was found to agree most closely with observable facts.

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EFFECT OF X-RADIATION UPON THE GROWTH OF AVENA SEEDLINGS

(Publication No. 5493)

Edgar Francis Riley, Jr., Ph.D.
State University of Iowa, 1953

Inhibition of growth by moderate exposures to x-radiation (50 kv. or 200 kv.) was related to mitotic activity in the structures of the Avena seedling. The leaves, roots, and coleoptiles with dividing cells were inhibited by 500 r while 2,000 r had no effect on the growth of older coleoptiles in which cell division had been completed.

The processes of cell elongation in sections excised from older coleoptiles were relatively insensitive to x-radiation, exposures of 75,000 r or 100,000 r being required to inhibit the processes. Measurements during the 24 or 48 hours after irradiation indicated that the inhibition of elongation was due to an inability of the cells to utilize the growth regulators available rather than to an inactivation of growth regulators in the cell. Since the exposures required to inhibit the activity of cytoplasm (as indicated by cell elongation) were more than 200 times the exposures inhibiting the activity of the nucleus (increase of cell numbers), the nucleus would seem to be the portion of the cell in which the reactions occur which lead to observable radiobiological effects after moderate exposures to x-radiation.

The inhibition of elongation by x-radiation was more pronounced when sections of coleoptile tissue were placed after irradiation on a substrate inducing a state of hyper-activity in the cytoplasm. Stimulated activity of the cytoplasm during the period of irradiation was also found to make the inhibitory effect of radiation more pronounced.

Aqueous solutions of indoleacetic acid (5×10^{-6} moles per liter) were partially inactivated by exposures of 10,000 r or more (200 kv. x-radiation) and completely inactivated by 50,000 r; solutions were assayed by means of the test using the straight growth of sections excised from the Avena coleoptile and floated on the solutions. The indoleacetic acid inactivated by x-radiation was not toxic to the coleoptile sections.

Investigation of the respiration of irradiated and untreated coleoptile sections placed on various substrates showed that an increase in elongation was accompanied by an increase in the rate of oxygen uptake. Sucrose induced a relatively large increase in the rate of oxygen uptake and, probably indirectly, a relatively small increase in elongation; the processes stimulated by supplementary sucrose were quite insensitive to exposures of 100,000 r of x-radiation. Indoleacetic acid caused a relatively small increase in the rate of oxygen uptake and a large increase in elongation; the processes stimulated by IAA were inhibited by 10^5 r of x-radiation.

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FOSSIL FRUITS AND SEEDS FROM THE EOCENE CLARNO FORMATION OF OREGON

(Publication No. 5727)

Richard Albert Scott, Ph.D.
University of Michigan, 1953

One of the uncommon occurrences of fossil fruits and seeds in the Tertiary beds of western United States is found in the Eocene Clarno formation of north central Oregon. The fruits, which are mostly siliceous locule casts surrounded by carbonized endocarpal remains, were obtained from a single locality in two unstratified beds of highly indurated rock of volcanic origin. About four hundred specimens have been collected.

Ten species of fruits and seeds have been identified from the Clarno locality. They represent eight genera and seven families. Eight of the species and three of the genera have not been described previously.

Fossil leaves are also known from the Clarno formation, and from them Chaney has identified seventeen angiosperm genera in fourteen families (unpublished data). There is little agreement between the lists based on the two types of remains. There is not a single genus in common, and only four families, the Vitaceae, Lauraceae, Menispermaceae, and Nyssaceae are found on both lists.

Although correspondence is slight, the affinities of the fruits and seeds bear out the previous interpretations of the Clarno and other early Tertiary floras known chiefly from leaves. These floras indicate humid, sub-tropical conditions in Oregon during the Eocene. One of the families represented by fruits and seeds, the Icacinaceae, is now exclusively tropical, and another, the Menispermaceae, is almost exclusively tropical. The major components of the western early Tertiary Flora, the Paleotropical, Neotropical, and temperate to warm temperate elements, are each represented by fruit and seed forms.

The numerically dominant form among the Clarno fruits and seeds is a new species of walnut (Juglans). This is the first walnut fruit known with certainty from rocks as old as the Eocene. This occurrence of Juglans demonstrates that the fruits of the walnut and the hickory (Carya) were generically distinct during Eocene time. It has been suggested previously that, although the leaves of the two genera are known to have been distinct during the Eocene, their fruits were not differentiated until later.

About two-thirds of the genera to which the Clarno fruits and seeds belong are extinct. This figure, comparable to that for the considerably larger fruit and seed flora from the Eocene London Clay, is much higher than is found for the American Eocene floras known principally from leaves. The higher proportion of extinct genera among the Clarno and London Clay fruit and seed assemblages than among the Eocene floras based on leaves suggests that the leaves of some early Tertiary plants may have differentiated along modern generic lines before their reproductive organs. Although the evidence is as yet scanty, it at least hints that when a greater number of fossil plants are known from reproductive structures, the prevalent concept of the largely modern generic composition of the early Tertiary floras may be partially modified.

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THE OCCURRENCE AND ROLE OF COENZYME A IN PLANTS

(Publication No. 5623)

Eli Seifter, Ph.D.
University of Pennsylvania, 1953

Supervisor: David R. Goddard

The thesis is concerned with two quite widely different aspects of Coensyme A (Co A) as related to higher plants. Accordingly it is divided into two parts. The first is a study of the distribution of Co A in various species of higher plants and in the tissues of these plants. The second is a study of the role that Coensyme A plays in the oxidation of pyruvic acid by higher plants.

Co A was assayed by two different techniques. One of these made use of the acetylating enzyme of pigeon liver for which Co A is a cofactor. The second method is one which is dependent upon the activity of a bacterial transacetylase enzyme for which Co A is also a cofactor. Both of these methods gave results which are in agreement with each other.

Co A was found to be present in a large number of flowering plants, and in non-flowering vascular plants. In general the coenzyme is present in high concentration in seeds, and in rather low concentration in leaf tissue, even when these are considered on a dry weight basis. Quantitative data on the amount of Co A present in plant tissue are given. Values of approximately 2 units per gram dry weight were obtained in the analyses for fruit tissues of the orange and apple. These represent the lowest concentration found in this study. The highest amounts determined were obtained from seed and embryo tissue. These approximate 45 units per gram dry weight.

Centrifugal fractionation of a homogenate of bean seedlings led to the isolation of mitochondria which particles were shown to contain greater than 1100 units of Co A per gram dry weight. Chemical isolation of a preparation from wheat germ yielded a product which contained approximately 50 units of Co A per milligram dry weight.

The main technique utilized in the study of the role of Co A in plant material was based upon chemical determination of reactants and products obtained from the incubation of plant enzymes with the substrates which were under study.

Mitochondria from mung bean seedlings were shown to contain an enzyme capable of condensing acetyl Co A and oxalacetate to form citrate. The same reaction was carried out by an enzyme derived from the dry seed. Enzymes from the mung bean were able to form acetyl Co A from pyruvate. Cocarboxylase, DPN, and Co A were shown to be essential for this reaction.

The point of view that Co A acts primarily in acetyl transfer rather than by a direct role in hydrogen transfer, is maintained. It was not shown, however, that Co A does not take part in an oxidative fashion.

It was concluded that the role of the coenzyme in the oxidation of pyruvate by the systems studied was related (1) to its role in the formation of acetyl Co A from pyruvate and (2) in the condensation of acetyl Co A and oxalacetate to form citrate. The mung bean enzymes were capable of effecting these reactions.

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ALGAE OF THE TENNESSEE VALLEY REGION: A MANUAL FOR IDENTIFICATION OF SPECIES

(Publication No. 5936)

Herman Silva, Ph.D.
Michigan State College, 1951

This is a report on investigations of fresh water algae, which have been in progress since 1941. A study has been made of the algae of the Tennessee Valley Region, defined here as the area included by the state of Tennessee and the Tennessee River Valley. Twenty-three hundred samples have been collected in seventy-five of the ninety-five counties of Tennessee and in six surrounding states, which include portions drained by the Tenesee River System.

The treatment here is primarily systematic, because this course of pursuit grew to such proportions that the numerous attractive ramifications which presented themselves could not be followed. A total of 927 species and varieties of algae distributed among 338 genera are considered. Original observations have been supplemented with information derived from study of the literature and after consultations with specialists in the various groups of algae. In general, the systems of Pascher, Fritsch, Smith, and Drouet have been followed in the taxonomic treatment with some modifications.

A key has been developed for the identification of all genera, and keys and descriptions are included for all species except the diatoms. Forty-six maps and plates containing four hundred figures supplement the written text. Pertinent taxonomic comments are presented, including brief descriptions of genera and families.

Fifteen new species or varieties are reported and described for the first time.

Microfilm copy of complete manuscript of 781 pages, $9.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1051.

THE NUTRITION AND PHYSIOLOGY OF ENTOMOPHTHORA CORONATA (COST.) KEVORKIAN

(Publication No. 5735)

Mary Charmaine Walsh Smith, Ph.D.
University of Michigan, 1953

The purpose of this study was to investigate the general physiology of the filamentous fungus Entomophthora coronata (Cost.) Kevorkian and to develop a synthetic nutrient medium which would produce yields of mycelium adequate for a future study of its biochemistry.

The first section of this investigation was devoted to the development of physiological techniques which would produce statistically significant results. The organism was grown in shake culture in order to provide uniform conditions for growth within the

medium. A technique utilizing mycelial fragments as inoculum was found to facilitate the work.

The effects of certain cultural conditions upon the morphology of the organism were then studied. Surface mycelial mats were found to be characteristic of liquid, stationary cultures, while hyphal balls and hyphal bodies developed in shake cultures. The production of the hyphal bodies was a function of nutrition as well as of shaking.

Following the discovery that the maximum mycelial yield was obtained between 25 and 38 hours after inoculation of media containing peptone, the effects of certain physical factors upon growth were investigated. First, mycelial yield was found to be greatly increased by shaking. Furthermore, under the conditions of these experiments, 15° C. appears to be the optimum temperature for growth in stationary culture, while the optimum pH is in the vicinity of 6.7. Within the range used, the buffer molarity had little effect upon growth.

The final section of the study was devoted to the investigation of the effects of selected commercial extracts, as well as minerals, vitamins, various nitrogen sources and certain sugars upon growth. From these experiments, it was shown that of the commercial products, yeast extract was the best food source. Magnesium and zinc were the only elements which, under test conditions, stimulated growth. Moreover, Entomophthora coronata appears to be autotrophic for vitamins since it grew well in a medium containing vitamin-free casein hydrolysate. Furthermore, vitamins, added to a synthetic medium, did not increase mycelial yields. That the fungus can utilize a wide range of nitrogen sources was amply demonstrated. Arginine HC1 however, proved to be the best nitrogen source and in concentrations of 150 to 200 mg. nitrogen per 100 ml. of medium produced optimal mycelial yields. Arginine HC1, supplied in catalytic amounts, was also found to increase growth in media containing valine. Of the carbon sources tested, a glucose concentration of 1.5 percent gave the best growth. The rate of growth in the chemically defined medium which was developed as a result of these studies was found to be slower than that in a medium containing peptone.

In conclusion it can be stated, that Entomophthora coronata grows well in a purely synthetic medium consisting of salts, arginine HC1, glucose and distilled water. Furthermore, there is evidence to suggest that this fungus is a physiologically primitive organism.

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ROOT TUMORS ON NICOTIANA AFFINIS T. MOORE INDUCED BY A CULTURE MEDIUM, AND THE ESTABLISHMENT OF TUMOR TISSUE CULTURES

(Publication No. 5751)

Katharine Tryon, Ph.D.
University of Michigan, 1953

Tumors have been produced on the roots of seedlings of Nicotinana affinis grown in the dark in sterile culture. The culture medium responsible for the abnormal growth is a mixture of mineral salts, sucrose, glycine, and vitamins (White's basal medium) with the addition simultaneously of malt extract and yeast extract. Tumor development was initiated by an abnormal proliferation and swelling of root hairs, followed by their collapse, and the lateral enlargement of cortical cells. Subsequent development involved the multiplication primarily of the cells of the pericycle, with the ultimate rupture and loss of the cortex altogether. The result was a conversion of the entire root into an unorganized mass of cells with differentiation limited to occasional irregularly-arranged lignified vascular elements of the same general type as those described elsewhere for other overgrowths. Nuclear enlargement and aberrant mitotic figures have been observed, but no polyploidy was distinguished.

The effectiveness of the tumefacient medium was shown not to be limited to roots, nor to the species, N. affinis. All species used were not equally susceptible to its tumefacient effects. Balsam, vetch, and grape also produced root tumors when grown on it.

Studies of the tumefacient medium showed that tumefaction occurred only at pH values between 5.3 and 6.0, and that the tumor-inducing principle contained in the medium was destroyed or inactivated after four days in light. It likewise deteriorated in the dark, but very much more slowly. The medium must be autoclaved for tumor formation to occur. If malt and yeast extracts are Seitz-filtered, the stimulus to tumorous growth is very greatly reduced. Common growth substances were shown not to produce comparable tumefaction on these plants, although naphthaleneacetic acid, at 10^{-4}g. per liter did induce aberrant growth. Likewise, the addition of four different auxin antagonists to the medium resulted in retarded growth in general, but not in reduced tumor formation in particular. Hormones are regarded as contributing but not initiating factors here, much as they evidently are in crown gall.

Analyses of the tumefacient medium showed the tumefacient factor, once it is formed, to be largely heatlabile, soluble in water and methanol but not in ether, and to be dialyzable. Substitutions of known constituents of the malt and yeast extracts for the extracts themselves produced results indicating that the nucleic acids in the extracts may be among the significant substances involved in inducing tumefaction.

Subcultures of the tumorous root tissue were made onto the same tumefacient malt-yeast extract

medium, and onto White's basal medium containing 10^{-4} g. per liter NAA. Successful establishment of six two-year-old clones of tissue is noted. None of it is habituated or capable of growth in the absence of either the extracts or auxin. The usefulness of such tissue in culture is indicated.

Differences among the types of vascular elements produced in the different clones, even when begun from the same tissue piece and with identical histories, is remarked. The similarity between the type of vascular tissue produced by tissues in culture in general and transfusion tissue in gymnosperms is noted.

The study of nuclear and associated metabolic changes, possibly induced by nucleic acids, especially DNA, is regarded as the most promising line for future investigation of the factors inducing changes in the form of growth in plants.

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CHEMISTRY

CHEMISTRY, GENERAL

A POLAROGRAPHIC STUDY OF SOME N-MONO-SUBSTITUTED ETHYLENEDIAMINE COMPLEXES OF COPPER, CADMIUM, LEAD, AND ZINC

(Publication No. 5668)

Dorothy Eyke, Ph.D.
University of Michigan, 1952

The purpose of this study was to determine the formulas and instability constants of the complex ions formed by copper, cadmium, lead, and zinc in aqueous solutions of ethylenediamine, propylenediamine, and five N-mono-substituted ethylenediamines. It was hoped that some insight could be gained concerning the effect of alkyl- and alkylol-substitution in ethylenediamine on the coordination number and stability of the complexes formed by these diamines.

The polarographic method, which was selected for this study, was used to obtain the half-wave potentials of the simple aquo ions and of the complex ions existing in several different concentrations of the diamines. The instability constants were determined from the difference in the half-wave potentials of the simple and complex ions, and the number of diamine molecules coordinated to each ion was calculated from the variation of half-wave potential with varying concentration of diamine.

The violet colored copper(II) complexes of ethylenediamine, propylenediamine and the N-methyl- and N-ethyl-ethylenediamines had the general formula $Cu(X)_2^{++}$, while the blue complexes of N-(2-hydroxyethyl)ethylenediamine and N-(2-hydroxylpropyl)ethylenediamine had the general formula, $Cu(X)_3^{++}$, where X represents the diamine molecule.

The polarographic data indicated that the N-(3-hydroxypropyl)ethylenediamine formed a very stable complex with copper in which only one diamine molecule was coordinated to the copper(II) ion. It is probable that this ion, which is pink in color, is not of the same general type as the complexes formed by the other diamines. In this complex ion, the diamine molecule may be functioning as a tridentate ligand, coordination occurring through the two nitrogen atoms and through the oxygen of the hydroxyl group. Water or a negative ion may occupy the fourth position. Supplementary studies using Bjerrum's method indicated the formation of complex ions of the types $Cu(X)^{++}$ and $Cu(X)_2^{++}$ in lower concentrations in this diamine.

The predominant ion formed by cadmium with most of the diamines was the tris-ion, $Cd(X)_3^{++}$. There was, however, evidence of the existence of the bis-ion in lower diamine concentration in some cases. Most of the zinc-diamine systems showed the formation of bis-complexes in low concentration of the ligand, and tris-complexes in higher concentration. As with copper, both cadmium and zinc formed complexes with N-(3-hydroxypropyl)ethylenediamine in which it is probable that coordination occurs through other atoms as well as nitrogen. The polarographic data for the lead systems indicate the formation of bis-complexes in most concentrations of the diamine.

In general, the unsubstituted diamines formed the most stable complexes. This would be expected since primary amine groups are usually better coordinators than secondary amine groups. Exceptions were the lead complexes formed by the alkylol-substituted amines and the somewhat different type ions formed by N-(3-hydroxypropyl)ethylenediamine with copper, cadmium, and zinc. The ethyl group, when substituted in ethylenediamine, has a greater effect in decreasing the stability of metal ion-diamine complexes than does the smaller methyl group.

In some instances it appears that the characterization of solutions can be definitely aided by the complementary use of both the polarographic method and Bjerrum's method.

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A TRACER STUDY OF THE REACTION BETWEEN SODIUM AND THE DIAMMONIATE OF DIBORANE

(Publication No. 5672)

Peter Raymond Girardot, Ph.D.
University of Michigan, 1952

In this investigation, the stable isotope deuterium was used as a tracer to determine whether boron-hydrogen bonds, nitrogen-hydrogen bonds, or both are broken when sodium reacts with the diammoniate of diborane in liquid ammonia solution.

Previous work had indicated that hydrogen might be expected to arise from breaking of N-H, rather than of B-H bonds, in accordance with the equation

$$B_2H_6.2NH_3 + Na \longrightarrow NaB_2H_6.NH_2 + NH_3 + 1/2\ H_2\ .$$

There was, however, sufficient experimental evidence to cast doubt on such an interpretation.

The compounds $B_2D_6.2NH_3$ and $B_2H_6.2ND_3$ were prepared by conventional techniques with due precautions against isotopic contamination. On reacting $B_2D_6.2NH_3$ with sodium in liquid NH_3, the hydrogen evolved was found to be pure H_2, but when $B_2H_6.2ND_3$ reacted with sodium in liquid ND_3, a mixture of H_2, HD, and D_2 was evolved. This means that only N-H bonds were broken in the first case, but that both N-H and B-H bonds were broken in the second. Isotopic analyses of hydrogen were made with an isotope ratio mass spectrometer.

The existence of a marked isotope effect has been postulated in support of the experimental evidence. This isotope effect, the preferential reactivity of H over D, has been previously observed in other reactions, and is a demonstration of quantum-mechanical differences between the two isotopes.

These data provide the first evidence for very weak cationic or acidic character of the hydrogen linked to boron in diborane dissolved in liquid ammonia.

An additional observation during the course of the sodium reaction was that not all of the sodium was used in hydrogen evolution, but about half of it was used in some other reaction. The formation of $Na_2B_2H_6$ in solution in liquid ammonia has been suggested as a tentative mechanism for this secondary process. These questions raised by stoichiometric relationships suggest a need for a reconsideration of the structure now accepted for the diammoniate of diborane.

A subsidiary investigation was made on the existence of isotopic exchange between sodium borohydride, $NaBH_4$, and D_2O, and between $NaBH_4$ and ND_3. In neither case was evidence found to indicate significant isotopic exchange between the hydrogen of $NaBH_4$ and that of the solvent.

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THE COMPOSITION OF A COBALT COMPOUND OF THIOGLYCOLIC ANILIDE

(Publication No. 5826)

Clinton Sheldon Hart, Ph.D.
University of Michigan, 1953

Problem:

The value of phenylthiohydantoic acid as a gravimetric precipitant for cobalt in the separation from iron is decreased by the fact that small amounts of iron always accompany the cobalt. Investigation showed that phenylthiohydantoic acid hydrolyzes to thioglycolic anilide which precipitates the cobalt; so, since nothing was known of the composition of the cobalt compound of thioglycolic anilide, this study was undertaken.

Results: (I) THE REACTION OF PHENYLTHIOHYDANTOIC ACID WITH COBALT (II)

Previous investigators showed that phenylthiohydantoic acid hydrolyzes to thioglycolic anilide when heated with dilute NH_4OH:

$$\begin{array}{l} CO\text{-}NH_2 \\ | \\ S\text{-}CH_2\text{-}CO\text{-}NH\text{-}C_6H_5 \end{array} \xrightarrow[\text{HOH}]{\text{dilute ammonia}} \begin{array}{l} H \\ | \\ S\text{-}CH_2\text{-}CO\text{-}NH\text{-}C_6H_5 \end{array} \xrightarrow{-CO_2\ -\ NH_3}$$

Phenylthiohydantoic acid

Thioglycolic anilide

Our experiments showed:

1. When a dilute solution of phenylthiohydantoic acid in ethanol is added to cobalt (II) in solution with NH_4OH and NH_4Cl, the mixture remains clear for several seconds before the dark red precipitate appears.

2. When a dilute solution of thioglycolic anilide in ethanol is added to a cobalt (II) solution as above, under parallel conditions, a red precipitate indistinguishable from the precipitate formed in 1, appears immediately.

Results: (II) THE COBALT COMPOUND OF THIOGLYCOLIC ANILIDE: PROPERTIES

The precipitate will not form in: dilute acid solutions, 10% NaOH, dilute KCN; it forms in: dilute NH_4OH, Na_2CO_3, $NaHCO_3$. Freshly-formed precipitate will not dissolve in 10% KCN, NaOH, HCl; it dissolves slowly in boiling HCl, HNO_3; rapidly in boiling aqua regia.

The dried precipitate is a dark red powder with greenish lustre melting at 255-260° C (uncorr.); decomposing on distillation at 4 mm.; insoluble in melted acetamide, acetone, ethanol, methanol, ethyl acetate, amyl acetate, benzene, toluene, formamide, pyridine, nitrobenzene, aniline, "Cellosolve", chloroform, carbon tetrachloride, carbon bisulfide, ethyl ether, petroleum ether (20-40°; 40-60°; 70-90°).

Preliminary analyses indicated the composition $Co(S-CH_2-CO-NH-C_6H_5)_3$. Purification being impossible, the compound was prepared by several methods. Analysis of these six preparations gave the results in Table I. Analysis for cobalt was by igniting, fusing oxide with pyrosulfate, using the perborate method on the melt; sulfur was done by ignition in a Parr Bomb with sodium peroxide, followed by precipitation as barium sulfate and weighing. Nitrogen was done by the Dumas method.

3. A new reactive grouping of value in organic reagents has been found:

where R_1 = hydrogen or alkyl

R_2 = aryl

TABLE I

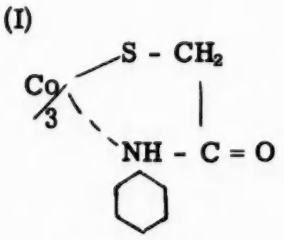
SUMMARY OF DATA: ANALYSIS OF COBALT COMPOUND OF THIOGLYCOLIC ANILIDE

	1	2	3	4	5	6	Theory
Reagent:	cold sl.exces.	cold 20% xs.	cold ------	boiling --------	boiling equiv.	boiling amounts	
Cobalt (II)	----	----	20% excess	20% excess	----	----	
ANALYSIS:							
Co	10.66%	10.67	12.70	12.42	11.30	11.39	10.56%
S	16.94	17.09	16.90	16.92	17.14	17.10	17.26
N	8.07	7.62	7.75	7.43	7.17	7.42	7.54
RATIOS:							
Co	1	1	1	1	1	1	1.0
S	2.9	2.9	2.4	2.5	2.8	2.8	3.0
N	3.2	3.0	2.6	2.5	2.7	2.7	3.0

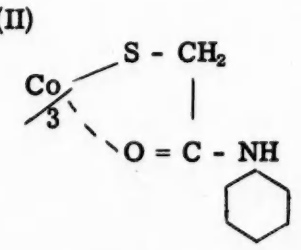
Results: STRUCTURE OF THE COBALT (III) COMPOUND

Thioglycolic anilide behaves as a monobasic acid through its -SH. The ratios in Table I show three radicals per cobalt. Cobalt(II) commonly becomes cobalt(III) in ammoniacal solution. Under anaerobic conditions no precipitate formed until air was admitted; attempts to study reaction rate by oxygen uptake were unsuccessful. The properties indicate an inner complex structure. Either the N or the O could coordinate with the cobalt to close the ring. Calculation of the angles showed that for (I) the chelating ring would have to be opened by $12^0 8'$; for (II) the ring would have to be closed by $19^0 28'$. (I) was favored, though possibility of a linear or a three-dimensional polymer could not be excluded.

(I)



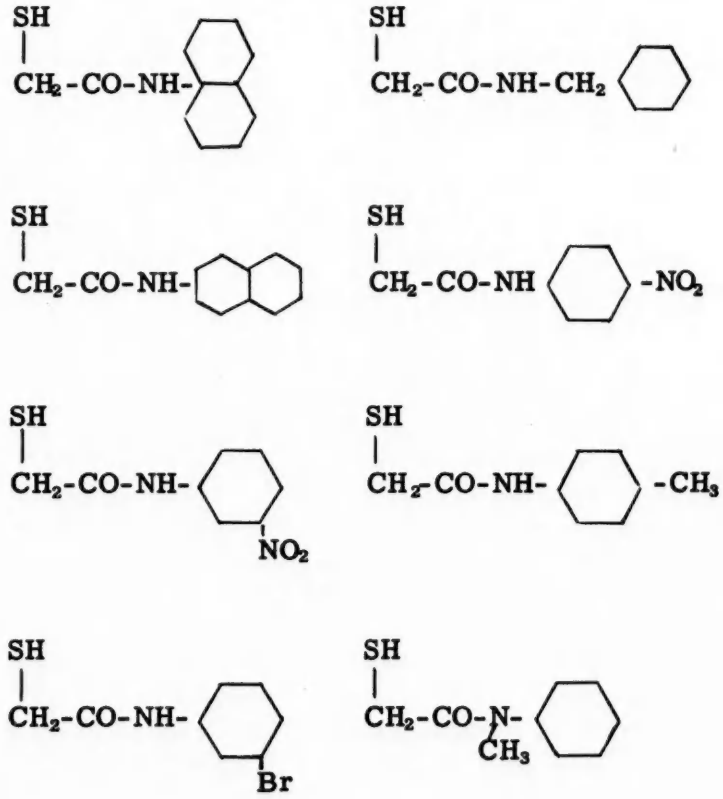
(II)



In Table II are the formulas for the variants prepared and tested. All gave cobalt compounds substantially the same as that from thioglycolic anilide.

TABLE II

SUBSTITUTED THIOGLYCOLIC ANILIDES



Conclusions

1. Phenylthiohydantoic acid hydrolyzes to thioglycolic anilide which reacts with cobalt(II); therefore the use of the name and of the substance should be discontinued in favor of thioglycolic anilide.

2. Analytical data support the empirical formula $[Co(S-CH_2-CO-C_6H_5)3]_X$

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STUDIES IN THE CHEMISTRY OF SULFONES

(Publication No. 5512)

John W. McFarland, Ph.D.
Vanderbilt University, 1953

Part A. Grignard Reagents of Sulfones. Reactions with Carbonyl Compounds.- In order to determine the characteristics of Grignard reagents of sulfones (RSO CR′R″MgX), the reactions of typical representatives with typical aldehydes and ketones were investigated. p-Tolylsulfonylmethylmagnesium bromide, prepared from methyl p-tolyl sulfone and ethylmagnesium bromide, reacts with acetaldehyde to give β-hydroxy-n-propyl p-tolyl sulfone which was characterized as its acetate, oxidized to p-tolylsulfonylacetone and dehydrated to 1-(p-tolylsulfonyl)-1-propene. p-Tolylsulfonylmethylmagnesium bromide also reacts with diisopropyl ketone to give γ-methyl-β-isopropyl-β-hydroxy-n-butyl p-tolyl sulfone and, unlike α-halo-sulfones in certain reactions, is accordingly not highly hindered.

α-(p-Tolylsulfonyl)-ethylmagnesium bromide, prepared from ethyl p-tolyl sulfone and ethylmagnesium bromide, adds to benzaldehyde to give α-methyl-β-phenyl-β-hydroxyethyl p-tolyl sulfone. This adduct was oxidized to α-(p-tolylsulfonyl)-propiophenone, which was identical with the product obtained from α-bromopropiophenone and sodium p-toluenesulfinate. Acetone reacts with the Grignard reagent of ethyl p-tolyl sulfone to give α,β-dimethyl-β-hydroxy-n-propyl p-tolyl sulfone.

The bromomagnesium derivative of isopropyl p-tolyl sulfone adds to benzaldehyde to give α,α-dimethyl-β-phenyl-β-hydroxyethyl p-tolyl sulfone, and to acetone to form α,α,β-trimethyl-β-hydroxy-n-propyl p-tolyl sulfone. This tertiary Grignard reagent neither adds to nor reduces diisopropyl ketone.

Benzohydryl phenyl sulfone did not afford a sulfonyl Grignard reagent when heated with ethylmagnesium bromide, but was cleaved to unidentifiable products.

Methyl sulfone forma a bromomagnesium derivative which reacts with benzaldehyde to give β-phenyl-β-hydroxyethyl methyl sulfone which proved to be identical with the product obtained by the catalytic reduction of α-(methylsulfonyl)-acetophenone.

Methyl sulfone with two moles of ethylmagnesium bromide gave a bis-Grignard derivative which reacts with two moles of acetone.

The reactivity of phenylsulfonylmethylmagnesium bromide relative to phenylmagnesium bromide was studied by allowing the two to compete for one equivalent of benzaldehyde. The relative amounts of products indicate that the sulfonyl reagent reacts at approximately the same rate as does the phenyl reagent although it is possible that a complex form of the two Grignard reagents which reacts differently than either would alone.

Part B. Grignard Reagents of Sulfones. Miscellaneous Reactions.- The reactions of sulfonyl Grignard reagents with substances other than carbonyl compounds were studied in order further to determine the nature of reactions involving this type of organometallic reagent. p-Tolysulfonylmethylmagnesium bromide adds to benzonitrile to give α-(p-tolylsulfonyl)-acetophenone imine, the structure of which was proved by hydrolyzing it to the known α-(p-tolylsulfonyl)-acetophenone.

p-Tolylsulfonylmalonanilide was prepared from the same halo-magnesium derivative and phenyl isocyanate. The structure of the dianilide was established by independent synthesis from diethyl p-tolylsulfonylmalonate and aniline.

Ethylene oxide with p-tolylsulfonylmethylmagnesium bromide produces γ-hydroxy-n-propyl p-tolyl sulfone, which was characterized as its 3,5-dinitrobenzoate.

Part C. Preparation and Reactions of Cyclic Sulfones.- The purpose of the work described in Part C was to prepare four-membered ring sulfones and to study their stabilities toward heat and ultraviolet light. Thiacyclobutane 1,1-dioxide, prepared by the oxidation of thiacyclobutane with hydrogen peroxide, was shown to be stable both toward heating at 260-270° and toward ultraviolet light.

α,α′-Dichlorodimethyl sulfide reacts with diethyl malonate and sodium ethoxide apparently to give diethyl 3,3-thiacyclobutanedicarboxylate. An attempt to oxidize this ester to the corresponding cyclic sulfone by the use of perbenzoic acid was unsuccessful.

Pyrolysis of the barium and calcium salts of thiodiacetic acid did not give the desired thiacyclobutan-3-one. Surprisingly, acetone was obtained from the pyrolysis, along with carbon dioxide and hydrogen sulfide.

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THE THERMAL DECOMPOSITION OF 2,3-PYRROLIDINEDIONES

(Publication No. 5714)

Lynn Randolph Peters, Ph.D.
University of Michigan, 1952

The purpose of this work was to study the thermal decomposition of a series of 2,3-pyrrolidinediones and related amides with a view to elucidating the mechanism by which 1,5-diphenyl-2,3-pyrrolidinedione is converted to N-cinnamylideneaniline and carbon dioxide upon heating.

Thermal decomposition with formation of carbon dioxide and cinnamylideneanilines is shown to be a general reaction of 1,5-diaryl-2,3-pyrrolidinediones but not of 4-aryl-2,3-pyrrolidinediones or other α-oxoamides.

A number of new 1,5-diaryl-2,3-pyrrolidinediones have been prepared by thermal rearrangement of the isomeric α-arylimino-β-benzylidenepropionic acids, obtained either from benzylidene-pyruvic acids and aromatic amines, or from N-benzylideneanilines and

pyruvic acid. The α-arylimino-β-benzylidenepropionic acids decarboxylate easily to give the same products which are obtained from the thermal decomposition of the corresponding 1,5-diaryl-2,3-pyrrolidinediones. In the one case studied kinetically, the decarboxylation proceeds at the same rate and with the same activation energy as the decomposition of the corresponding 2,3-pyrrolidinedione.

The α-imino acid - 2,3-pyrrolidinedione rearrangement is shown to be reversible. In methanol, 1,5-di(4-methoxyphenyl)-2,3-pyrrolidinedione appears to be in equilibrium with α-(p-methoxyphenylimino)-β-(p-methoxybenzylidene)propionic acid as shown by ultraviolet absorption and electrical conductivity data. The equilibrium constant and rate constants were determined conductometrically by assuming the molar conductance of α-(p-methoxyphenylimino)-β-(p-methoxybenzylidene)propionic acid to be equal to the molar conductance of α-(p-methoxyphenylimino)-γ-(p-methoxyphenyl)butyric acid. The kinetic measurements are consistent with a reversible first order equilibrium.

The specific rate of formation of α-(p-methoxyphenylimino)-β-(p-methoxybenzylidene)propionic acid from 1,5-di(4-methoxyphenyl)-2,3-pyrrolidinedione in methanol is about 18 times the specific rate of carbon dioxide evolution in the thermal decomposition of 1,5-di(4-methoxyphenyl)-2,3-pyrrolidinedione in o-dichlorobenzene. Hence it is concluded that the thermal decomposition of 1,5-diaryl-2,3-pyrrolidinediones occurs through rapid conversion to the isomeric α-arylimino-β-benzylidenepropionic acids, followed by decarboxylation as a slower, rate determining step.

The rate of carbon dioxide evolution of each of a series of 1,5-diaryl-2,3-pyrrolidinediones having methoxy and/or nitro groups in the para positions of the aryl rings was determined manometrically in order to observe the effect of intramolecular electronic effects on the reaction rate and thus to gain some evidence as to the mechanism.

The observed rates of evolution of carbon dioxide from the 2,3-pyrrolidinediones are shown to be consistent with current theories of decarboxylation, as applied to the corresponding α-imino acids.

The decarboxylations in rather dilute (0.00159 moles per 20 ml. solvent) solutions follow first order paths. They appear to be both acid and base catalyzed. The rates are sensitive to the solvent in which the decarboxylations are carried out.

Spectroscopic evidence indicating that the 2,3-pyrrolidinediones exist chiefly in the enolic form is also presented.

In an appendix a number of new derivatives of 2-Oxo-3-pentenoic acid obtained in the course of unsuccessful attempts to prepare the free acid have been reported.

Methods which failed to give enol derivatives of 1,5-diphenyl-2,3-pyrrolidinedione are also appended.

A third appendix contains a report of cyclic products obtained as the result of unsuccessful attempts to prepare analogs of α-arylimino-β-benzylidenepropionic acids having RNH- and CH_3O- in place of -OH.

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CHEMISTRY, BIOLOGICAL

STUDIES ON SOME PHYSICAL AND CHEMICAL CHANGES IN MILK IN FROZEN STORAGE

(Publication No. 5524)

George Christianson, Ph.D.
University of Minnesota, 1953

Part I. Coagulation of milk as a result of frozen storage.

When milk is held in frozen storage a jelling and subsequent coagulation of protein occurs. The physical and chemical properties of the coagulum were investigated and means were sought to prepare milks that did not exhibit this destabilization while stored in the frozen state. The work also included confirmation experiments of work done by others in the field.

Definite evidence was obtained that indicated that the coagulum was casein; changed in physical properties so that it precipitated from the rest of the milk, but unchanged chemically or biochemically insofar as could be ascertained. The precipitate resulting from frozen storage was found to be dispersed by pH manipulation (lowering to 4.0 and returning to 6.8). The redispersed casein was identical to freshly prepared casein with respect to electrophoretic mobility, and calcium and rennet precipitation properties.

Modified and synthetic milks were prepared that were less subject to casein destabilization. The dialysis of milk against distilled water lowered the salts, lactose and non-protein-nitrogen components and resulted in a "milk" with unlimited frozen storage stability. The removal of calcium and other ions also increased the time required for the coagulation reaction to occur in frozen storage, but more calcium had to be removed by exchange methods than by dialysis to accomplish the same results. A sodium caseinate sol failed to show any destabilization in frozen storage, but if calcium ions were added the usual coagulation occurred.

Part II. Determination of calcium ion concentration in milk.

A successful method for measuring the concentration of calcium and magnesium ions in milk was developed. This method depends on the principle that when milk is equilibrated against a cationic exchanger, the amounts of calcium, magnesium, sodium and potassium adsorbed are functions of the concentration of these respective ions. A relatively large amount of milk is equilibrated against a small amount

of exchanger; the amount of calcium and magnesium adsorbed is then determined. The sodium and potassium contents of the milk are determined with a flame photometer, and standard curves relating calcium and magnesium ion concentration to calcium and magnesium adsorbed are prepared by using solutions of chlorides containing sodium and potassium at the same level as in the milk sample and the expected range of calcium and magnesium. The calcium and magnesium ion concentrations are then read from the standard curve.

Considerable work was expended in selecting a suitable exchanger exhibiting a satisfactory change in calcium adsorbed per unit change in the calcium ion activity. Certain other characteristics were necessary, including: desirable column behavior, ease of elution of adsorbed cations and failure to adsorb complex calcium ions such as phosphates and citrates.

When a satisfactory overall technique had been developed, attention was turned to analysis of milk samples. Typical results on two samples of mixed herd skimmilk are:

		Estimated Ion Level	
		Calcium	Magnesium
Samples	Treatment	mg./100 ml.	mg./100 ml.
1	None	8.4	2.1
2	None	9.3	2.1
2	Heated to 85° C.	6.8	1.8

Other data demonstrated that lowering pH increased the calcium ion levels and that the addition of citrate lowers calcium ion levels.

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THE RIBONUCLEIC ACIDS OF CERTAIN VIRUSES AND OF THE CHLOROPLASTS OF TURKISH TOBACCO PLANTS

(Publication No. 5790)

William Dewar Cooper, Ph.D.
Stanford University, 1953

Tobacco mosaic virus, Holmes' masked strain and preparations of normal and infected chloroplast material from Turkish tobacco plants were studied in regard to their ribonucleic acid composition. Samples of nucleoprotein material were fractionated by a modified Schmidt-Thannhauser procedure and the ribonucleotide fractions were analysed for the purine and pyrimidine components by the spectrophotometric methods recently published by Loring et al. The distribution of phosphorus in all extracts and fractions was determined and the concentrations of the various purine and pyrimidine bases were related to the respective phosphorus contents on a mole per mole basis.

The direct application of the Schmidt-Thannhauser procedure to the fractionation of tobacco mosaic virus resulted in loss of ribonucleotides due to absorption by the protein. Consequently, the procedure was modified to include re-solution and reprecipitation of the protein-desoxyribonucleic acid residue. This method facilitates a reasonably good characterization of the phosphorus content of tobacco mosaic virus. The results indicate that the phosphorus is associated primarily with ribonucleic acid. No evidence was found for phosphoprotein or phospholipid components. The amount of any desoxyribonucleic acid present was shown to be very small.

For tobacco mosaic virus, the results found for the analysis of intact nucleoprotein were compared with those obtained for determinations on isolated nucleic acid samples, prepared by two different methods. No significant differences were found for the purine and pyrimidine composition of whole nucleoprotein and the nucleic acid prepared by heat denaturation. However, the nucleic acid isolated by the alkali method of Johnson and Harkins was shown to have a lower uridine content. These data are compared with that obtained by Knight and by Markham and Smith for isolated samples of tobacco mosaic virus nucleic acid prepared by heat denaturation. The results of Knight and the present data show reasonable agreement and were obtained with virus produced in Turkish tobacco plants. However, the data of Markham and Smith, for virus multiplied in White Burley tobacco plants, appear different. Consequently, a variation in the composition of the virus ribonucleic acid is suggested when the virus is produced in different hosts.

The ribonucleic acid composition of the Holmes' masked strain was found similar to that for tobacco mosaic virus. Consequently, the explanation of differing biological properties in these two strains appears to be one of structure or of minute analytical differences which are within the error of the methods used.

The yield of nucleic acid, obtained after heat denaturation of tobacco mosaic virus, varied with the age of the virus following extraction from the plant. The similarity in the analyses of the different amounts of the isolated nucleic acid indicates a high degree of uniformity in the virus nucleic acid.

A method was developed for the isolation and extraction of chloroplasts from normal and virus infected Turkish tobacco plants. No difference was found in the ribonucleic acid composition of these preparations, however more trichloroacetic acid soluble phosphorus was shown associated with normal chloroplast material. This phosphorus is not associated to an appreciable extent with low molecular weight adenine compounds. The ribonucleic acid composition and content of the chloroplasts was shown to be different from that of tobacco mosaic virus.

The applicability of the methods of analysis employed in the present study have been considered in relation to suitable recovery experiments for the compounds determined.

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BIOCHEMICAL STUDIES OF SEX AND PATHOGENICITY IN USTILAGO ZEAE (BECKM.) UNG.

(Publication No. 5528)

James Edson DeVay, Ph.D.
University of Minnesota, 1953

The common smut of corn, Ustilago zeae (Beckm.) Ung., is usually heterothallic and comprises multiple sex groups. No method has yet been found, outside the host, of determining the sexuality of lines in this species. Thus, studies of sexual compatibility must be made in conjunction with pathogenicity studies.

Certain monosporidial haploid lines, if inoculated singly into the region of the apical meristem of corn seedlings, can cause the new leaves within the older leaf sheaths to grow faster, resulting in masses of curled and distorted leaves. As neither typical gall tissue nor chlamydospores have been found in association with these curled leaves, the stimulus produced by solopathogenic (diploid) lines or a cross of compatible haploid lines, which causes hypertrophy of host cells, is apparently missing.

This study was made to determine if physiologically active substances could be detected which controlled sexual and pathogenic compatibility between haploid lines of U. zeae, and if certain biochemical characteristics were specific for any one sex group.

Inoculations of haploid line $10A_4$, when supplemented with cell-free filtrates of cultures of the compatible haploid line $17D_4$, into corn seedlings (6-8 leaf stage), caused stronger curl-reactions than inoculations with cells of $10A_4$ alone plus sterile water. Similar results were obtained when cells of $17D_4$ were supplemented with cell-free filtrates of cultures of $10A_4$.

Chromatographic analyses of liquid shake cultures of lines $17D_4$, $10A_4$, and of solopathogenic line 410qq for physiologically active substances, such as amino-acid peptides, that might influence virulence were negative. However, quantitative and qualitative differences were found in the free amino-acid content of the cultures.

The following free amino-acids were found in culture extracts of lines $17D_4$, $10A_4$, and 410qq: aspartic acid, glutamic acid, serine, glycine, threonine, alanine, glutamine, lysine, arginine, gamma-amino butryic acid, proline, valine, leucine and/or isoleucine, phenylalanine, and tyrosine. Differences were observed in the concentrations of aspartic acid, glutamic acid, and glutamine in these extracts. The extract of line $10A_4$ contained an unknown ninhydrin-reacting compound, which was not found in the other extracts. Another unknown was found only in the extract of line 410qq.

Free amino-acids accumulated best in poorly aerated liquid cultures, but their concentrations decreased gradually after the cultures reached a certain age. Growth rate and glucose utilization were much greater in the highly aerated cultures than in the poorly aerated ones. Chromatograms of the sugars in culture extracts of lines $17D_4$, $10A_4$, and 410qq did not show the marked differences that existed between the amino-acid chromatograms.

Studies were made of haploid lines from several sex groups to determine whether the amino-acid chromatograms were characteristic of the groups, but there was as much variability in the production of free amino-acids between lines from the same group as between lines from different groups. No marked differences were found in the bound amino-acid content of acid hydrolysates of these lines.

The following bound amino-acids were found: aspartic acid, glutamic acid, serine, glycine, threonine, alanine, lysine, arginine, proline, valine, tyrosine, leucine and/or isoleucine, cystine, methionine, histidine, and two unknowns that were not found in the free amino-acid extracts.

Distinct variability was observed in the virulence of certain crosses between haploid lines. Albino corn seedlings developed smut galls as well as chlorophyllous seedlings.

Further experiments are planned in which protein fractions from certain lines would be studied using serological relationships and electrophoretic methods of analysis in an attempt to relate fundamental protein differences or similarities of these lines to their mating types.

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I. A VITAMIN-TEST DIET FOR CHINOOK SALMON. II. THE WATER SOLUBLE VITAMIN REQUIREMENTS OF CHINOOK SALMON

(Publication No. 5895)

John Emil Halver, Ph.D.
University of Washington, 1953

A vitamin-test diet for Chinook Salmon was developed by formulating a vitamin-free basal diet and supplementing the ration with crystalline vitamins. The basal diet ingredients consisted of vitamin-free casein plus DL-methionine plus L-tryptophan 55%, purified gelatin 15%, purified corn oil 9%, white dextrin 8%, alpha cellulose flour 9%, minerals 4%. The vitamin supplement consisted of thiamin hydrochloride 6mg., riboflavin 20mg., pyridoxine hydrochloride 4mg., nicotinic acid 80mg., calcium pantothenate 28mg., inositol 400mg., biotin 0.6mg., folic acid 1.5mg., p-aminobenzoic acid 40mg., choline 800mg., ascorbic acid 200mg., alpha tocopherol 40mg., menadione 4mg., beta carotene 1.2mg., activated 7-dehydrocholesterol 4.5mcgm., and crystalline vitamin B_{12} 9mcgm. per 100 gms. of dry ingredients. Preparation of the diet was accomplished by adding all the dry ingredients to a warm gelatin solution and blending thoroughly in a mechanical mixer. The diet could be prepared as a floating or sinking diet by altering the speed of the mixer. A floating diet containing 25% solids was found optimum for initial feeding and a slowly sinking diet containing 30% solids was found acceptable for more advanced feeding. The diet was tested for two years on two different strains of Chinook Salmon and comparisons

with 100% liver diet fish indicated no statistically significant difference in growth or mortality during a 16 week feeding period. Representative samples were closely examined for indications of any vitamin deficiency syndrome but none were observed. The diet was demonstrated adequate for the production of normal growth of Chinook Salmon for a period sufficient for the development of vitamin deficiency syndromes.

The water soluble vitamin requirements of Chinook Salmon fry were determined by feeding groups of 500 fry diets deficient in one water soluble vitamin. The levels of all other vitamins in each respective group was allowed to remain constant. After 20% of the initial population died exhibiting various specific vitamin deficiency syndromes, the respective groups were divided in half: one half was fed the complete test diet and the other half was allowed to continue on the respective deficient diet until exhausted. Measurements of growth and mortality were compared with control lots for significance. Specific deficiency syndromes in Chinook Salmon were described for thiamin, riboflavin, pyridoxine, pantothenic acid, inositol, biotin, choline, and folic acid. Nicotinic acid and vitamin B_{12} deficient groups exhibited some abnormalities but the results were inconclusive. Ascorbic acid and para-aminobenzoic acid deficient fish exhibited no recognizable deficiency syndromes under the experimental conditions used.

The requirement of Chinook Salmon fry for the water soluble vitamins was tentatively established as including thiamin, riboflavin, pyridoxine, pantothenic acid, inositol, biotin, choline and folic acid. Descriptions of vitamin deficiency syndromes in Chinook Salmon were described for riboflavin, pyridoxine, pantothenic acid, inositol, biotin, folic acid, and choline.

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THE ENZYMATIC SYNTHESIS OF ALPHA-ACETOLACTATE FROM PYRUVATE BY PROTEUS MORGANII EXTRACTS

(Publication No. 5481)

Yutaka Kobayashi, Ph.D.
State University of Iowa, 1953

The carboxylation of pyruvic acid to form oxalacetic acid under anaerobic conditions by cell-free extracts of Proteus morganii could not be demonstrated. Bicarbonate was eliminated as the source of the labile carboxyl of the beta-keto acid formed enzymatically with the use of radioactive bicarbonate.

Oxalacetate decarboxylase activity of the cell-free extracts has been demonstrated. Evidence was presented to show that large amounts of oxalacetic acid could not be piled up by the enzyme at a pH of 8.1, the pH of the "carboxylation" experiments, eliminating oxalacetic acid as a possible product of pyruvate fermentation by cell-free extracts of P. morganii.

Paper chromatographic analysis of the pyruvate fermentation broth revealed a spot which corresponded to oxalacetic acid. Attempts to isolate oxalacetic acid as the 2,4-dinitrophenylhydrazone have failed. Colorimetric determinations for oxalacetic acid in the broth showed the presence of a smaller amount of oxalacetic acid than the chromatographic method could detect. An explanation for the appearance of this spot has not been found.

The chemical behavior of known alpha-acetolactic acid together with the results of experiments with pyruvate-1-C^{14} have indicated that the primary product of the anaerobic pyruvate fermentation was probably alpha-acetolactic acid. Balance studies with pyruvate-1-C^{14} which showed the presence of an equivalent amount of diacetyl and radioactive carbon dioxide liberated by aniline citrate, coupled with the fact that acetoin was absent prior to the addition of aniline citrate to the fermentation mixture, gave strong support to this conclusion. The acetoin was oxidized to diacetyl and the diacetyl identified as the semicarbazone and the 2,4-dinitrophenylhydrazone.

Cocarboxylase has been shown to be a cofactor for alpha-acetolactic acid formation. The role of magnesium and manganese ions has been established through dialysis experiments and with the use of Versene. The possible function of coenzyme A in this system has been indicated by the use of the ion-exchange resin, Dowex-1.

The production of alpha-acetolactic acid has been shown to be enzymatic and to be directly proportional to the enzyme concentration and the time of incubation. Balance studies showed that three moles of pyruvate disappeared for every mole of alpha-acetolacetate synthesized. High concentration of bicarbonate and added cocarboxylase increased the yield of product. L-Malate alone could not substitute for pyruvate. L-Malate added to pyruvate did not noticeably affect the yield of product obtained from pyruvate alone.

The cell-free extracts were prepared by three methods: glass grinding, alumina grinding and by sonic disruption. It was found that the activity of the cell-free extracts could be preserved by lyophilization. The activity of the cell-free extracts was measured in terms of microliters of gas produced by aniline citrate per milligram of nitrogen per unit time of incubation.

Pyruvic acid has been shown to decompose slowly in the presence of aniline citrate. The decomposition appeared to be accelerated by the presence of protein.

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I. THE IDENTIFICATION, ISOLATION, AND PROPERTIES OF YEAST PROTEIN NO. 2. II. A REACTION OF REDUCED DIPHOSPHOPYRIDINE NUCLEOTIDE CATALYZED BY PROTEIN NO. 2 OR ACID

(Publication No. 5908)

Gale William Rafter, Ph.D.
University of Washington, 1953

I. The Identification, Isolation, and Properties of Yeast Protein No. 2.

Incidental to the isolation of hexokinase from yeast Kunitz and McDonald isolated three crystalline proteins.[1] These investigators were unable to find any catalytic activity associated with these proteins. One of these proteins, yeast protein No. 2, was shown in the present study to be D-glyceraldehyde 3-phosphate dehydrogenase. Identification of protein No. 2 as D-glyceraldehyde 3-phosphate dehydrogenase was made by comparison of various physical and biological properties of protein No. 2 with similar properties described for D-glyceraldehyde 3-phosphate dehydrogenase crystallized from yeast some years earlier by Warburg and Christian.[2] It was shown that protein No. 2 possessed the same enzymatic activity toward D-glyceraldehyde 3-phosphate, the same absorption coefficient at 280 mμ, and the same electrophoretic mobility as yeast D-glyceraldehyde 3-phosphate dehydrogenase.

Certain modifications were made in the isolation of protein No. 2 as described by Kunitz and McDonald that gave large yields of crystalline protein No. 2 in a minimum of time. At pH 8 it was shown that protein No. 2 crystallized readily eliminating prolonged storage of protein fractions. It was also shown that by combination of several protein fractions that the quantity of isolated protein was increased many fold.

The purity of protein No. 2 was investigated by electrophoretic and ultracentrifugal analysis, and by a phase solubility study. Protein No. 2 was found to be inhomogenous by electrophoretic analysis and by a phase solubility study while by ultracentrifugal analysis it appeared homogeneous.

II. A Reaction of Reduced Diphosphopyridine Nucleotide Catalyzed by Protein No. 2 or Acid.

A reaction of reduced diphosphopyridine nucleotide catalyzed by protein No. 2 was described. The reaction was shown to involve a shift of the reduced absorption band of the nucleotide to a lower wave length. The reaction was characterized with regard to pH optimum, dependence of the rate on protein concentration, anion dependence, and inhibitors of the reaction. Both diphosphopyridine nucleotide and iodoacetic acid were shown to be inhibitory to the reaction. Certain anions were found to serve in the catalysis of the reaction; pyrophosphate ion was found to be most efficient in this regard.

An attempt to find a yeast fraction more active than crystalline protein No. 2 in the catalysis of the reaction described above was unsuccessful.

The spectral changes found in the enzymatic reaction were found to be identical with spectral changes found when reduced diphosphopyridine nucleotide was treated with dilute acid. The chemical nature of the product of the acid reaction was investigated using N substituted dihydropyridine compounds. The product of the reaction was found to possess carbonyl reactivity not shown by the dihydro compounds.

1. Kunitz, M. and McDonald, M., J. Gen. Physiol., 29, 393 (1946).
2. Warburg, O. and Christian, W., Biochem. Z., 303, 40 (1939).

Microfilm copy of complete manuscript of 91 pages, $1.14. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1064.

THE BIOSYNTHESIS OF D-GLUCOSAMINE

(Publication No. 5611)

Sidney V. Rieder, Ph.D.
University of Pennsylvania, 1953

Supervisor: John M. Buchanan

The biosynthesis of glucosamine has been studied by feeding carbon and nitrogen labeled compounds to hens and by isolating glucosamine from the ovomucoid of newly laid eggs. When glucose-1-C^{14} and $N^{15}H_4Cl$ were fed, both were rapidly incorporated into the glucosamine. The comparison of the C^{14} and N^{15} concentration of this newly formed glucosamine to that of blood glucose and uric acid, respectively, indicated that the labeled compounds fed are major precursors of glucosamine. Furthermore, it appears that a nitrogen precursor of uric acid may well be a nitrogen precursor of glucosamine. Degradation of the glucosamine isolated after feeding glucose-1-C^{14} showed that 75 percent of the isotope was in carbon atom 1 of the glucosamine, a fact which indicates that a large part of the glucosamine was formed directly from glucose without skeletal rearrangement of the carbon chain. It was also found that the glutamic acid isolated from the coagulated egg white proteins, after feeding $N^{15}H_4Cl$, contained only a small amount of N^{15} when compared to the N^{15} concentration of the glucosamine isolated from the same egg. In addition, the data of these experiments permitted the half-life of the glucosamine available for ovomucoid synthesis to be calculated. The half-life, as determined by both C^{14} and N^{15} labeled compounds, was found to be approximately 2 days.

The chemical structure of glucosamine shows that it has features in common with both carbohydrates and amino acids. The hypothesis that glucosamine could be formed by the condensation of an amino acid, as serine or glycine, with a carbohydrate, as glyceraldehyde or erythrose, respectively, was tested by feeding N^{15}-glycine-1-C^{14}. The isolated glucosamine contained relatively small amounts

of N^{15} and C^{14} indicating that glycine is a poor carbon and nitrogen source of glucosamine and that neither it nor probably serine participate directly in the biosynthesis of glucosamine.

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COFACTORS AND HYDROGEN ACCEPTORS OF THE PHOSPHOROCLASTIC REACTION OF CLOSTRIDIUM BUTYRICUM

(Publication No. 5633)

Ralph Stoner Wolfe, Ph.D.
University of Pennsylvania, 1953

Supervisor: D. J. O'Kane

The phosphoroclastic reaction of Clostridium butyricum was studied using cell-free water extracts of the organism. The extreme lability of the enzyme system toward oxygen could be minimized by the addition of K ascorbate or ferrous sulfate during preparation of the cell-free extract. The phosphate requirement of the reaction was readily replaced by arsenate.

Various hydrogen acceptors were conveniently used to simplify the reaction but no hydrogen uptake could be observed using these compounds. Connection of the reaction to molecular oxygen was possible through use of auto-oxidizable flavin derivatives.

A dependence of the reaction on cocarboxylase, coenzyme A, and ferrous ions was revealed by ammonium sulfate and Dowex treatment of the cell-free extract. The pyruvate oxidation factor is present in minute amounts only and appears not to be involved in the phosphoroclastic reaction.

The exchange reaction between C^{14} labelled CO_2 and the carboxyl group of pyruvate was found to be very rapidly catalyzed by the cell-free extract. The exchange reaction was found to be more stable than the phosphoroclastic reaction.

A dependence of the exchange on cocarboxylase, coenzyme A, and phosphate was revealed by treatment of the cell-free extract with ammonium sulfate or Dowex. No effect on the exchange was observed by the addition of ferrous ions.

The relation of the exchange reaction to the phosphoroclastic reaction is discussed.

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THE RELATION BETWEEN THE NATURE OF THE DIETARY PROTEIN AND THE PRODUCTION OF EXPERIMENTAL ALCAPTONURIA IN THE WHITE RAT

(Publication No. 5758)

Helen Lun Chen Wu, Ph.D.
University of Michigan, 1953

Although experimental alcaptonuria has been reported frequently since the first successful demonstration in the white rat in 1938, a relation between a dietary deficiency of protein and certain amino acids and the production of alcaptonuria, induced by the ingestion of tyrosine or phenylalanine, in the deficient animals has been shown only recently. Therefore, it was decided to investigate further the influence of the nature of the dietary protein on experimental alcaptonuria. A comparison of the effectiveness of the DL- and L-forms of phenylalanine and tyrosine in this respect was also made.

Male white rats were given purified diets containing different proteins as casein, gliadin and zein. After 10 days on the diet, tyrosine or phenylalanine was added to the food at a level of 0.3 - 0.5 gm. per 100 gm. of body weight per day for 3 days. Urinary homogentisic acid was determined by the iodometric method. Alcaptonuria (increased excretion of homogentisic acid) generally appeared on the second day of the ingestion of the aromatic amino acid. Termination of the administration of phenylalanine or tyrosine brought the homogentisic acid level promptly back to the normal value.

When DL-phenylalanine was given to rats maintained on a 5% casein diet, the resulting excretion of homogentisic acid was twice as great as the amount excreted by rats fed a 20% casein diet. It seems probable that insufficiency of dietary protein may retard the synthesis of the enzyme protein which oxidizes homogentisic acid. A comparison of the effects of 20 and 50% casein diet on alcaptonuria produced by DL-phenylalanine showed that slightly higher homogentisic acid excretion was obtained in rats fed the 50% casein diet.

The excretion of homogentisic acid by rats fed 18.4% gliadin and DL-phenylalanine was 8-10 times that of the paired mates receiving 18.3% casein (same N content) and DL-phenylalanine. When the gliadin diet was supplemented with lysine, the homogentisic acid excretion produced by DL-phenylalanine was similar to that of the casein-fed paired mates.

When DL-phenylalanine was added to a zein diet supplemented with tryptophan and lysine, the excretion of homogentisic acid by the rats was much higher than that of the paired mates fed a casein diet (same N content) and DL-phenylalanine. Successive removal of first lysine and then tryptophan from the supplemented zein diet progressively intensified the alcaptonuria brought about by the feeding of DL-phenylalanine. It is suggested that zein when supplemented with the missing essential amino acids, lysine and tryptophan, may still be lacking in other essential amino acids quantitatively.

Thus it seems probable that a deficiency of dietary protein quantitatively or qualitatively may influence the capacity of the animal organism to handle a large excess of the aromatic amino acids in a normal manner.

It was found that while DL-phenylalanine invariably produced more homogentisic acid than a similar dose of the L-form in the casein fed rats, the same relationship did not obtain with DL- as contrasted with L-tyrosine. L-Phenylalanine was less effective as a homogentisic acid precursor than L-tyrosine. The probable explanations for these observations were discussed.

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CHEMISTRY, INORGANIC

A METHOD OF ANALYSIS FOR LOOSELY BOUND SULFUR

(Publication No. 5834)

Alexis Adrian Babineau, Ph.D.
Clark University, 1953

Analytical methods for the determination of combined sulfur are either highly specific or depend essentially on complete oxidation of all the sulfur to sulfate and its determination by means of barium ion. It is known that "loosely bound" sulfur in such compounds as polythionates rearranges in alkaline solution to form thiosulfate and sulfide or sulfate depending on the sulfur oxygen ratio. Since thiosulfate is formed by the air oxidation of sulfides in excess of hydroxyl ion, it should be possible to determine total sulfur by iodine titration.

In a study of the oxidation of polysulfide, Bullock and Forbes in 1932 used aromatic nitro compounds in alkaline solution and obtained quantitative yields of thiosulfate. The present work deals with the action of aromatic nitro compounds on sodium trithiocarbonate and perthiocarbonate in alkaline solution.

The trithiocarbonate was formed by adding definite amounts of carbon disulfide to solutions of sodium sulfide of definite concentration and stirring until complete solution was obtained. The perthiocarbonate was prepared by adding weighed quantities of sulfur to the above solutions.

All the sulfur in these solutions was oxidized to thiosulfate by alkaline solutions of aromatic nitro compounds. The thiosulfate was determined by iodine titration of the samples after bringing the solutions to a pH of 3.5.

Various aromatic nitro compounds were used in an effort to find the one which gave the most satisfactory yield and the simplest procedure. Two-phase oxidation by nitrobenzene under refluxing conditions did not give 100 percent oxidation of the sulfur to thiosulfate. This method also necessitated separation of the two phases and extraction of the aniline from the water solution before titration in order to prevent iodine from being picked up by the amine.

Two water-soluble nitro compounds were tried: p-nitrobenzoic acid and m-nitrobenzene sulfonic acid. The latter was found to be satisfactory for this procedure. The drawback of the p-nitrobenzoic acid lay in the property of the reduced substance, the aminobenzoic acid, to pick up iodine and so interfere with the titration of the thiosulfate. The free acid also has a tendency to precipitate from solution which hampers the iodine titration.

The potassium salt of m-nitrobenzene sulfonic acid is easily prepared and purified from the technical acid. The reduced product, metanilic acid, when tested with iodine showed no absorption.

The difficulties encountered with this oxidant were finally resolved.

The first was the length of time needed for complete oxidation. When the trithiocarbonate solutions were allowed to stand at room temperature with the alkali and the aromatic nitro compound, 8-9 days were necessary to obtain complete conversion to thiosulfate. The reaction was speeded up by gentle boiling. The first attempt gave results which were 1.6 percent too high. Subsequent trials with boiling during one hour and two hours, respectively, gave yields of 100.7 percent and 99.93 percent.

The second difficulty was hanging end-points and the reproducibility of titrations. End-points faded away quite quickly in the early experiments and even when duration of color for several similar samples was timed, the iodine value of the samples differed appreciably.

The source of the trouble was found to be the pH of the solution being titrated. Rather than rely on the color of indicators, a pH meter was used to bring the acidity of the samples to the same value. It was found that if the pH were brought down to seven and then the iodine were added, reproducible values could be obtained which were within one percent. The end-points did not fade so quickly, but lasted for at least a minute. If the acidity were then brought to 3.5 - 4.0, a permanent deep-blue color reappeared if the titration had been complete. Subsequently, the titrations with iodine were made after the pH had been lowered to 3.5 and in all cases, the end-points were permanent.

While this method was developed for study of the thiocarbonate ions, it seems that its broader applications should be of interest to workers in sulfur chemistry.

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THE DETERMINATION OF ARSENIC AS ARSENI-12-TUNGSTATE

(Publication No. 5507)

Harry McGinnis Brazzell, Ph.D.
Vanderbilt University, 1953

A method for the determination of arsenic gravimetrically within the limits 0.05 to 4.0 milligrams of arsenic has been developed.

This method is based on the conversion of arsenate ion to arseni-12-tungstate ion by treatment with excess tungstate ion in acid solution of pH 0.5 to 1.5 with subsequent precipitation of the arseni-12-tungstate with tetraphenylarsonium chloride or with cinchonine.

If tetraphenylarsonium chloride is used as the precipitant, the precipitate is washed with dilute hydrochloric acid, the precipitate dried and weighed as tritetraphenylarsonium arseni-12-tungstate, $(C_6H_5)_4As_3\ AsO_4.12WO_3$. If cinchonine is used as the precipitant, the precipitate is washed with a dilute solution of the cinchonine precipitant and subsequently ignited in a porcelain or platinum crucible to $(As_2O_5)_{\frac{1}{2}}.12WO_3$. A favorable low gravimetric conversion factor for arsenic is obtained in either case.

The conversion of arsenate ion to arseni-12-tungstate ion is accomplished by the slow acidication of a solution containing the arsenate ion and an excess of tungstate ion using hydrochloric or nitric acid. The conversion is rapid and complete at 60° C. and above, but various amounts of water of constitution exist in the precipitate if precipitation is carried out at pH levels above 1.5. The precipitate, when formed at active acidities equivalent to pH 1.5 and below, contains no water of constitution.

Removal of excess tungstate is accomplished prior to the precipitation of the complex heteropoly-acid ion by precipitation of tungstic acid with concentrated hydrochloric acid. The precipitated tungstic acid is filtered on retentive paper and washed with dilute ammonium nitrate solution, recovering the filtrate and washings quantitatively.

The lower limit of amounts of arsenic which can be determined by this method is set by the unavoidable loss of precipitate in transfer while the upper limit is set by the efficiency with which the precipitated arseni-12-tungstate can be washed free of occluded mother liquor and foreign ions as well as adsorbed excess precipitant.

The use of cinchonine gives inconsistent results unless the precipitate is ignited to constant weight at approximately 500° C. The ignition time must not be prolonged or error due to disproportionation and subsequent volatilization of some of the precipitate will result.

Silicate, phosphate, and germanate, as well as metal ions which form insoluble chlorides must be absent or be removed by preliminary treatment. Metal ions, such as mercuric and stannic, which form complex chlorides which react with the precipitant to produce insoluble compounds interfere. Stannic, vanadyl, ferrous and other similar reducing ions destroy the complex and, hence, must be absent or be destroyed by previous oxidation. Anions which react directly with the precipitant, tetraphenylarsonium ion, such as MnO_4^-, ReO_4^-, IO_4^-, ClO_4^-, I_3^-, SCN^- interfere as well as citrate, tartrate, acetate, and sulfate.

Most of the simple cations and many anions do not interfere and borate ion, BO_2, does not interfere.

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THE DETERMINATION AND DISTRIBUTION OF COPPER IN SEA WATER

(Publication No. 5892)

Tsaihwa James Chow, Ph.D.
University of Washington, 1953

The spectrophotometric determination of copper in sea water has been studied using sodium diethyldithiocarbamate as the color forming reagent. This reagent, compared with the frequently used dithizone, afford simpler operation, less interference from other metallic ions, higher sensitivity, and greater accuracy. Xylene has been found to be most desirable for extracting the copper diethyldithiocarbamate. Factors studied in some detail include the effects of varying the shaking time, concentration as it affects the efficiency of extraction, amount of reagent, hydrogen ion concentration, chlorinity, concentration of oxidizing and reducing agents, and the stabilities of the diethyldithiocabamate reagent and the colored copper diethyldithiocarbamate. The composition of the colored complex has been determined by the continuous variation method. Procedures for minimizing the effects of interfering substances have also been discussed.

Copper has been determined using the diethyldithiocarbamate and spectrophotometric method in water samples of oceanographic and estuarine origin. Several fresh water lakes have also been examined. The copper contents of some bottom sediments from Puget Sound, Elliot Bay, Lake Union and Lake Washington have been determined. The distribution and fluctuation of the copper concentration in sea water have been studied with respect to location, depth, tidal effect, time of year, river discharge, and other constituents of sea water.

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A SPECTROPHOTOMETRIC STUDY OF THE SODIUM VANADATES AND ITS ANALYTICAL APPLICATION

(Publication No. 5594)

Irvin M. Gottlieb, Ph.D.
University of Pennsylvania, 1953

Supervisors: J. F. Hazel and W. M. McNabb

The application of the technique of absorption spectrophotometry in the ultra-violet to the study of the structure of complex inorganic anions in aqueous solution has been limited to date to a relatively few isolated cases as compared to its routine use in the determination of the structure of simple and complex organic molecules. In the course of the development of a spectrophotometric analytical procedure for the determination of trace quantities of vanadium at a concentration level of 1-30 micrograms per ml. in certain ores, rocks and minerals, unexpected abnormalities and variations in the Beer's Law behavior of the absorption characteristics of solutions of the vanadates lead to the present study by the technique cited above of the effect of changes in the pH of solution on the nature of the complex vanadate ion present.

By taking solutions known to contain pure ortho, pyro and meta vanadate ions and by diluting without changing the pH of the solution, characteristic patterns of absorption for these ions in the ultra-violet were obtained.

With solutions of constant vanadium content, this study indicates that aggregation of the ion causes a decrease in the number of aggregates in the solution, and a resultant increase in the transmittancy of the solution. With the increase in the acidity of these solutions there is observed a corresponding increase in the transmittancy of the solution, which indicates that there is a reduction in the number of kinetic aggregates accompanied by an increase in the number of oxygenated vanadium atoms in the aggregate. By the use of this method and based on the results obtained, the structure of the so-called "metavanadate" ion appears to be a tetravanadate ion.

As shown by a preliminary study of the chromate and phosphate systems, the ultra-violet spectra of solutions prepared at appropriate concentration levels appear to be a means of determining the degree of polymerization of the isopoly anion, and secondly, reveal the differences in structure between individual phosphate anions of the same degree of polymerization but with different structures.

The spectrophotometric study in the ultra-violet of various ions in sodium hydroxide has not been reported in the literature. A survey of the spectra of several oxygenated metallic anions in one molar sodium hydroxide has been made in this present study. Spectra were obtained for chromium as chromate, manganese as permanganate, tungsten as tungstate, molybdenum as molybdate, phosphorous as phosphate and vanadium as vanadate. There are indications that suitable absorption maxima occur for several of these ions for possible application in quantitative analysis. As an example of the application of these spectra, a method for the determination of trace amounts of vanadium was investigated utilizing the ultra-violet absorption of sodium orthovanadate in 1 molar sodium hydroxide at a wave length of 270 mu. A suggested spectrophotometric procedure for the determination of phosphate in terms of molybdate is presented. Two component analysis of mixtures of chromium and vanadium was attempted using their ultra-violet spectra, and shows promise for analytical use.

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A STUDY OF THE FREEZING OF SEA WATER

(Publication No. 5905)

Kurt Herbert Nelson, Ph.D.
University of Washington, 1953

The order of formation of solid phases when sea water freezes has been investigated down to a temperature of -40° C. About eighty-eight percent of the water present in the original quantity of sea water is transformed into ice before the first salt crystallizes. Sodium sulfate decahydrate, the first salt formed, begins to separate at -8.2° C. and the sulfate concentration in the brine decreases markedly. When the freezing point reaches -23° C., sodium chloride dihydrate precipitates in large quantities. The concentration of sodium in the brine decreases rapidly as the freezing point decreases below -23° C. There is a decrease in the concentrations of magnesium and potassium in the brine below -36° C. when potassium chloride and magnesium chloride dodecahydrate precipitate. Thermal analysis studies indicate the calcium chloride hexahydrate begins to form at -54° C. The last of the brine solidifies at a temperature slightly below -54° C.

Examination of ice formed by freezing sea water in the laboratory revealed that twenty to twenty-five percent of the salts in sea water are retained in the ice either as brine or deposited salts. The concentration of salts in the ice increases slightly with depth below the surface when the ice is formed at air temperatures below -5° C. The expected increase in salt content for the porous ice in contact with the bottom brine is found for all temperatures. In addition, a small amount of brine appears on the surface of the ice at lower temperatures.

When the ice melts in contact with the brine, the resulting water shows decided stratification. Although the bulk of the salts are in the bottom water derived mainly from the brine, the upper waters contain a sizeable amount of the total salts due to convection currents and mixing during the melting of the ice. The surface water is relatively fresh since it is formed from the last of the salt free ice.

If the brine is removed from the ice before it melts, the first water drained from the melting ice

possesses a high salinity due to the natural washing out of occluded salts and brine. The concentration of salts in the outflowing water constantly diminishes until the last thirty percent of the water is potable. The yield of fresh water can be increased by refreezing the partially desalted water.

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THE CATALYSIS OF THE HYDROLYSIS OF GLYCINE AMIDE BY METAL IONS

(Publication No. 5906)

Robert Andrew Newton, Ph.D.
University of Washington, 1953

This investigation was undertaken to obtain a better understanding of the mechanism of hydrolysis of peptides by metal activated peptidases. A more immediate objective was to determine if metal ions possessed any catalytic activity by themselves and if so whether or not it would be possible to increase the effect by the use of relatively simple organic compounds which could form complexes with the metal ions.

The literature on metal activated proteolytic enzymes was reviewed and the relationship between the properties of metal ions and the nature of the specificity which they show in the activation of proteolytic enzymes is discussed. Preliminary experiments in phosphate-citrate and phosphate-borate buffers shows that both Cu^{++} and Co^{++} catalyze the hydrolysis of glycine amide at pHs from 6.5 to 9.5 even at the very low concentrations which were present in these solutions.

In a search for complexing agents which would increase the solubility of Co^{++} and Cu^{++} in this pH range ten compounds were studied and several were found to be very effective. One of these, 2-amino-2-hydroxymethyl-1,3-propanediol, was used as both a complexing agent and a buffer in a study of five additional metal ions. It was found that Ni^{++} was easily soluble and was a very active catalyst. Although only partially soluble, Zn^{++} was also quite active. The others (Fe^{++}, Mg^{++}, and Mn^{++}) were not appreciably soluble and seemed to have only a slight catalytic effect.

The effect of the concentration of the metal ion was determined using four concentrations of Ni^{++} in 2-amino-2-hydroxymethyl-1,3-propanediol buffer at pH 9. The rate of hydrolysis of glycine amide was found to approach a maximum as the Ni^{++}: glycine amide ratio approached unity.

The variation of the rate of hydrolysis of glycine amide from pH 7 to pH 9.4 was determined in 2-amino-2-hydroxymethyl-1,3-propanediol buffer and compared with the rates found under the same conditions in the presence of Cu^{++}, Co^{++}, and Ni^{++}.

ΔH and ΔS were determined for the hydrolysis of glycine amide in 2-amino-2-hydroxymethyl-1,3-propanediol buffer at pH 9, for the Ni^{++} catalyzed hydrolysis under the same conditions and for the Cu^{++} catalyzed hydrolysis in phosphate-borate buffer at pH 9 with aminoethylethanolamine as the complexing agent.

Eight systems of complexing agent plus metal ion were shown not to be affected by the presence of light.

A preliminary study of the hydrolysis of glycylglycine at pH 9 in 2-amino-2-hydroxymethyl-1,3-propanediol buffer without metal; in the presence of Ni^{++} and in phosphate-borate buffer in the presence of Cu^{++} indicated that both metals show an appreciable catalysis.

The results are discussed in terms of possible mechanisms for the metal catalyzed hydrolysis of glycine amide.

A discussion of possible interpretations of certain aspects of the mechanism of action of metalloenzymes is given.

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AN ELECTROMETRIC STUDY OF THE REACTIONS OF ZINC AND CADMIUM IONS WITH SODIUM SILICATES

(Publication No. 5619)

David Emory Scheirer, Ph.D.
University of Pennsylvania, 1953

Supervisor: J. F. Hazel

The sulfates, chlorides, and nitrates of zinc and cadmium have been titrated with sodium silicates. These silicates had silica to soda ratios of 1:1, sodium metasilicate, 1:2, sodium orthosilicate, and 3:29:1, E Brand sodium silicate. The concentrations of the salts titrated were of the order of 0.02 normal.

Three electrometric methods were used to follow the course of the titrations: (a) amperometric, using a dropping mercury cathode; (b) conductometric; and (c) potentionmetric, using a glass electrode. The pH and conductance measurements were made during the same titrations.

The titration of zinc chloride with sodium metasilicate gave an average end point at 101 per cent equivalence, with only small differences between the three methods employed.

The titration of zinc chloride with sodium orthosilicate was characterized as a stoichiometric reaction; the average end point was at 100 per cent equivalence.

Zinc chloride required 107 per cent equivalents of E Brand sodium silicate to reach the end point in the titrations. A definite upward shift in the end point was encountered in all the titrations with E Brand silicate.

The titrations of zinc sulfate and zinc nitrate with the sodium silicates followed courses similar to those of zinc chloride. An anomalous break occurred in the conductometric curve when zinc nitrate was titrated with E Brand silicate.

Cadmium chloride reacted nearly stoichiometrically titrated with sodium metasilicate. The average end point in the three titrations was 98 per cent equivalence.

A definite formation of basic salts was indicated in the titration of cadmium chloride with sodium orthosilicate. The amperometric end point, supporting electrolyte present, occurred at 91.5 per cent equivalence, and the conductometric and potentiometric end points were at 96 per cent and 97 per cent equivalence respectively.

The amperometric titration of cadmium chloride with E Brand sodium silicate required an exactly equivalent quantity of base to reach the end point. However, the potentiometric and conductometric required 105 per cent and 108 per cent, respectively.

The titrations of cadmium sulfate followed a pattern similar to that of cadmium chloride. However, there was more tendency toward basic salt formation. The conductometric curve exhibited an anomalous break at 74 per cent equivalence. This is interpreted as being due to adsorption and desorption effects.

The titrations of cadmium nitrate with the sodium silicates also followed about the same course as those of cadmium chloride. However, the amperometric end points with metasilicate and E Brand sodium silicates both occurred at 100 per cent equivalence.

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SOLUBILITY AND SOLUBILITY PRODUCTS OF THE ZINC SALTS OF 8-QUINOLINOL AND SOME DERIVATIVES

(Publication No. 5883)

Charles William Weber, Ph.D.
Indiana University, 1953

The solubility products of the slightly soluble complexes of metals with 8-quinolinol and its derivatives have appeared in the chemical literature. In general the investigators assumed that these compounds undergo complete dissociation upon solution. They concerned themselves with a limited range of pH values and usually the conditions of ionic strength were not reported. The amphoteric nature of the analytical reagents involved was often ignored. With the assumption of complete dissociation upon solution, the formation constants for the various stages of complexing were not considered.

In the present study the slightly soluble zinc salts of 8-quinolinol, 2-methyl-8-quinolinol, and 5,7-dibromo-8-quinolinol, were allowed to saturate buffer solutions during agitation in a constant-temperature bath. The systems were studied throughout the range of pH values from 4.5 to 9.0, under constant conditions of ionic strength. This was possible through the use of the Veronal-acetate buffer system, which permits a wide range of pH values.

Radioactive tracer techniques were selected as the method for determining the total concentration of the metallic species in solution. The solubilities of most of these compounds can be as low as 10^{-7} molar or even less; thus most conventional methods of analysis are not applicable. Zn^{65} (t1/2 = 250 da.) was selected as the tracer for zinc. This was used as the central atom of the complexes studied.

At periodic intervals, samples of the thermostatted solutions were withdrawn with suction through sintered glass immersion tubes. The pH was measured with a Beckman Model G pH-meter. Twenty-five milliliter portions of the solutions were pipetted into Marinelli type double-walled flasks and counted with a bismuth-wall Geiger-Müller tube. Molar concentrations were determined by comparison with the activity of a standard radioactive Zn^{++} solution, counted under identical conditions. Six or eight weeks were necessary in most cases to ensure solubility equilibrium.

The experimental results were applied to several possible theories of complete dissociation in an effort to calculate consistent values for the solubility product throughout the pH range. No treatment assuming complete dissociation gave consistent values. By involving the stability constants for the various stages of complexing, along with both ionization constants of the amphoteric reagent, the experimental results successfully indicated that the mode of dissociation of these compounds upon solution was stepwise rather than complete. Final calculations showed that the equilibrium solutions contained not only the free metallic ion, but also the partially complexed form and probably the fully complexed species.

Since the systems were studied at 25° C. and at 40° C., it was also possible to determine the heats of solution of the compounds.

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CHEMISTRY, ORGANIC

AN ATTEMPTED SYNTHESIS OF α-HOMOCHELIDONINE

(Publication No. 5781)

Donald M. Balcom, Ph.D.
Stanford University, 1953

The chelidonine alkaloids are members of the naphthophenanthridine or benzo(c)phenanthridine sub-group of the isoquinoline alkaloids. They are chelidonine, α-homochelidonine, sanguinarine, chelerythrine, oxychelidonine, methoxychelidonine, oxysanguinarine, and dihydrosanguinarine. Structures for these compounds have been proposed based on degradative work, and the constitution of chelerythrine and sanguinarine have been established by synthesis.

The present work was undertaken to develop a method for the synthesis of α-homochelidonine. The proposed synthesis is contingent on the synthesis of a substituted isoquinolone, N-methyl-3-(3,4-methylenedioxyphenyl)-7,8-dimethoxy-1,2,3,4-tetrahydro-4-isoquinolone. A variation of the Pomeranz-Fritsch isoquinoline synthesis was employed in the attempted synthesis of this substituted isoquinolone. Three substituted amino acids, α-(N-methyl-2,3-dimethoxybenzylamino)-3,4-methylenedioxyphenylacetic acid, α-(N-acetyl-2,3-dimethoxybenzylamino)-3,4-methylenedioxyphenylacetic acid, and sodium α-(2,3-dimethoxybenzylidenamino)-3,4-methylenedioxypheylacetate were prepared, but all efforts to cyclize these amino acids to the desired isoquinolone were unsuccessful.

The cyclizing reagents used included phosphorus pentoxide, phosphorus oxychloride, liquid hydrogen fluoride, boron trifluoride, anhydrous stannic chloride, sulfuric acid, sodium amide, potassium amide, and sodium methoxide. Liquid hydrogen fluoride cleaved a methoxyl group from compounds bearing two adjacent methoxyl groups, producing a compound containing one methoxyl group and a free phenolic group. Phosphorus pentoxide and phosphorus oxychloride produced a small amount of an unidentified highly-fluorescent substance when allowed to react with α-(N-acetyl-2,3-dimethoxybenzylamino)-3,4-methylenedioxyphenylacetic acid. The remaining reagents either had no effect upon the amino acids or produced tars and other decomposition products.

A method for the preparation of N-methylbenzylamines by the catalytic hydrogenation with Raney nickel of a mixture of aromatic aldehyde and methylamine was developed. The catalytic hydrogenation with Raney nickel also produced better yields of benzylamines from the aldoximes than previously had been obtained by other methods.

The Schiff base, 1-(2,3-dimethoxybenzylidenamino)-2-naphthol, was prepared by the condensation of 1-amino-2-naphthol with 2,3-dimethoxybenzaldehyde. Attempts to cyclize this compound to 7,8-dimethoxybenzo(c)phenanthridine with phosphorus oxychloride or sulfuric acid were unsuccessful.

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THE ACTIONS OF ACIDS ON ALKYLIDENE-bis-AMINES II. FORMATION OF AMINO-ETHERS AND OF ACETALS

(Publication No. 5577)

James Corbett Browne, Ph.D.
University of Pennsylvania, 1953

Supervisor: E. C. Wagner

An investigation has been made of the reaction products resulting from the actions of acids on alkylidene-bis-amines and Schiff bases in non-aqueous media. The results are explicable by an ionic hypothesis suggested in an earlier paper from this laboratory.[1] The essence of this hypothesis is the formation of a carbonium-ammonium ion $[R\overset{H}{N}CH_2 \longleftrightarrow R\overset{H}{N}{=}CH_2]^+$ as a result of proton attack upon either the alkylidene-bis-amine or Schiff base, thus:

$$RNCH_2NR \rightleftharpoons \left[RNCH_2\overset{H}{N}R\right]^+ \rightleftharpoons RNH_2 + \left[CH_2NR \longleftrightarrow CH_2 = \overset{H}{N}R\right]^+$$

$$RN = CHR' \overset{H^+}{\rightleftharpoons} \left[RN = CHR' \longleftrightarrow \overset{H}{R}NCHR'\right]^+$$

This reactive entity may be thought of as capable of initiating reaction sequences consistent with the ionic hypothesis. In way of substantiating this hypothesis the following results were obtained.

The action of anhydrous acid upon alkylidene-bis-amines in the presence of anhydrous alcohols, earlier found to effect cleavage of the alkylidene-bis-amine with the subsequent formation of amine salt,[2] resulted in the formation and isolation of acetals. Dry hydrogen chloride acting upon methylene-bis-piperidine, benzylidene-bis-morpholine and benzylidene-bis-piperidine in the presence of the appropriate anhydrous alcohol, gave the following acetals: methylal, benzaldehyde diethyl acetal and benzaldehyde dibutyl acetal.

Dry hydrogen chloride and anhydrous methanol in conjuction with benzalaniline and the Schiff bases resulting from n-butylamine and formaldehyde, and isopropylamine and formaldehyde, gave benzaldehyde dimethyl acetal and methylal. The latter two Schiff bases exist in the form of the cyclic trimer, the 1,3,5-trisubstituted hexahydrotriazine, and bear at least a superficial resemblance to the linear alkylidene-bis-amine system; however benzalaniline exists as the monomer, and thus the formation of acetal from it is more striking in regard to the question of a common ionic intermediate resulting from the acid-induced cleavage of the alkylidene-bis-amine and Schiff base systems.

The reaction of alkylidene-bis-amines with anhydrous alcohol and acid, in the form of pyridine hydrochloride, resulted in the formation of amino-ethers, R_2NCH_2OR. Equimolecular amounts of amine salt and alcohol were used and the reaction time shortened, factors believed to be favorable to the formation of this type of compound. Methylene-bis-piperidine and methylene-bis-diethylamine reacting with pyridine hydrochloride and dry ethanol, yielded N-(ethoxymethyl)piperidine and N-(ethoxymethyl)diethylamine respectively.

The reaction of alkylidene-bis-amines, derived from primary aromatic amines, with anhydrous acids alone was expected to result in the formation of alkylidene halides and amine salts. No alkylidene halides were isolated and this was attributed to other reactions involving the aromatic nuclei, known to occur in compounds of this type under acidic conditions, thus involving the alkylidene group in a form

where it could no longer be liberated as the alkylidene halide.

1. McLaughlin and Wagner, J. Am Chem. Soc., 66, 251 (1944)
2. Hunt and Wagner, J. Org. Chem., 16, 1792 (1951).

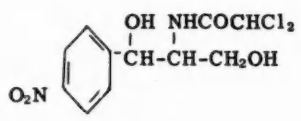
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A PYRIDINE ANALOG OF CHLOROMYCETIN

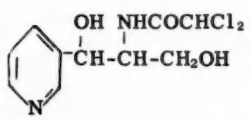
(Publication No. 5789)

David Ellsworth Clark, Ph.D.
Stanford University, 1953

The introduction of antibiotics into general chemotherapeutic use has given medicine an invaluable weapon in the neverending fight to conquer disease. Of this family of drugs, Chloromycetin (I), which has been assigned the generic name chloramphenicol, has been the only one to have lent itself to commercial synthesis.



(I)



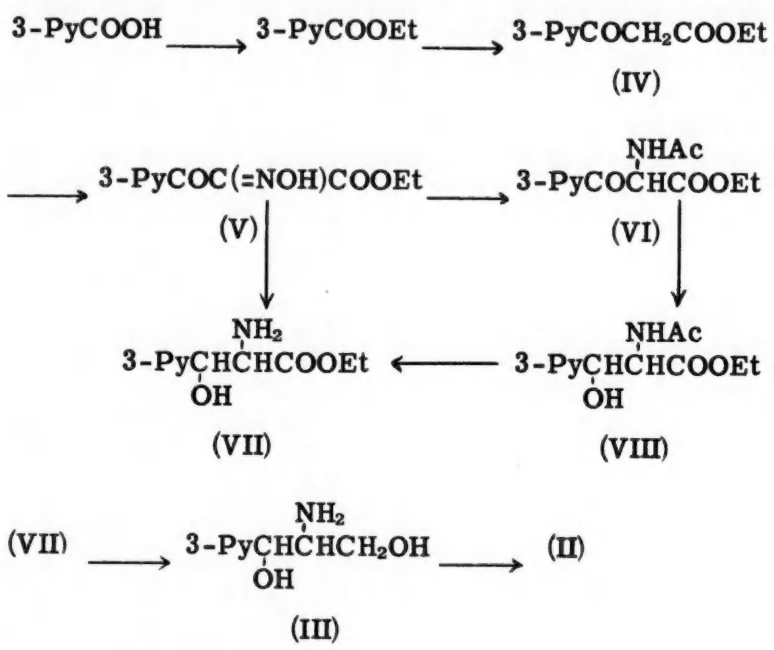
(II)

It was the purpose of this investigation to attempt the synthesis of a pyridine analog of Chloromycetin, 1-(3-pyridyl)-2-dichloroacetamido-1,3-propanediol (II), not only with the hope of obtaining a substance posessing even greater activity than the natural antibiotic, but to study the effect of such a replacement of a pyridine ring for a phenyl in the antibiotic field.

The successful reduction of several amino esters to amino alcohols by means of lithium aluminum hydride [Karrer, P., Helv. Chem. Acta, 31, 102 (1948)] suggested that the necessary intermediate, 1-(3-pyridyl)-2-amino-1,3-propanediol (III), might be obtained by the similar reduction of ethyl β-(β-pyridyl) serinate. The amino diol would be expected to give the desired pyridine analog upon treatment with methyl dichloroacetate.

A consideration of the various syntheses of threonine [Albertson, N., J. Am. Chem. Soc., 70, 1151 (1948); Pfister, K., ibid., 71, 1101 (1949); Adkins, H., ibid., 60, 1328 (1938)] indicated a possible approach to the ethyl β-(β-pyridyl) serinate.

The ethyl nicotinoylacetate (IV), prepared by the Claisen condensation of ethyl nicotinate and ethyl acetate, was readily converted to ethyl nicotinoylisonitrosoacetate (V) by nitrous acid. The reduction of this substance in the presence of palladium on charcoal gave ethyl nicotinoylacetamidoacetate (VI), which was further reduced by sodium borohydride to ethyl N-acetyl-β-(β-pyridyl)serinate (VIII). The direct reduction of the isonitrosoacetate (V) to ethyl β-(β-pyridyl)serinate (VIII) was accomplished by the use of a large quantity of Raney nickel catalyst in ethyl alcohol.



No configurational studies were attempted, and it is not known whether the pyridylserinate formed was of the threo or erythro series. However, the hydrochlorides of the pyridylserinate obtained by direct reduction and by hydrolysis of the N-acetyl derivative (VIII) gave a mixed melting point depression, which indicated that they were of different configurations.

The pyridylserinate was reduced by lithium aluminum hydride to 1-(3-pyridyl)-2-amino-1,3-propanediol (III). A crystalline amino diol was not obtained, but it was characterized by means of its tribenzoyl derivative and was readily converted to the desired pyridine analog of Chloromycetin (II).

A second synthetic route extensively studied depended upon the availability of β-pyridyl acetamidomethyl ketone. It was hoped that this substance might be converted to the amino diol (III) by condensation with formaldehyde and hydrolysis of the acetyl group. The preparation of a logical precursor, β-pyridyl aminomethyl ketone hydrochloride, by literature methods [Burrus, H., J. Am. Chem. Soc., 67, 1468 (1945); Clemo, G., J. Chem. Soc., 1934, 1739] did not prove satisfactory. Other attempts to prepare the ketone or an equivalent compound included both chemical and catalytic reduction of β-pyridyl isonitrosomethyl ketone, condensation of β-pyridyl chloromethyl ketone with potassium phthalimide, and the condensation of β-pyridyllithium with hippuronitrile and hippuryl chloride. These methods failed, and this synthetic route was abandoned due to the successful preparation of the Chloromycetin analog from ethyl β-(β-pyridyl)-serinate.

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STUDIES ON THE ELECTROPHILIC SUBSTITUTION REACTIONS OF AZULENE

(Publication No. 5893)

Edward J. Cowles, Ph.D.
University of Washington, 1953

On the basis of quantum mechanical calculations, the following predictions had been made previously concerning the conjugated bicyclic compound azulene:

1. Azulene, although non-benzenoid, should possess the "aromatic character" associated with compounds of the benzene family.
2. With respect to the electrophilic substitution reactions characteristic of aromatic compounds, azulene should be far more reactive than benzene.
3. Monosubstitution by an electrophilic groups should occur almost exclusively at the 1-position of the azulene nucleus.
4. If a 1-substituted azulene undergoes attack by a second electrophilic reagent, the second group should substitute almost exclusively at the symmetrically situated 3-position, regardless of the nature of the 1-substituent.

Previous experimental work had verified predictions 2 and 3 for numerous electrophilic substitution reactions, including acetylation and nitration.

In the present investigations, azulene was benzylated and the product was shown to be identical with 1-benzylazulene synthesized from 1-indanone. Thus alkylation was added to the list of electrophilic substitutions proven to occur at position 1.

1-Benzylazulene was acetylated and 1-acetylazulene was benzylated, and the two disubstituted products were shown to be identical (and, therefore, 1-benzyl-3-acetylazulene). Thus prediction 4 was substantiated unequivocally for the first time. Analogous confirmatory results were obtained from the acetylation of 1-nitroazulene and the nitration of 1-acetylazulene.

An analysis of the visible spectra of seventeen compounds, proven or assumed to be 1-substituted or 1,3-disubstituted azulenes, showed that the six substituent groups studied fall into two classes: those which cause a bathochromic shift of the absorption bands of the spectrum of azulene, and those which cause a hypsochromic shift. For each substituent an average value was calculated for the shift ($\Delta\ \lambda$max) in the position (λmax) of the central, main absorption peak. With two exceptions, the value of λ max calculated from the average values of $\Delta\ \lambda$max agreed sufficiently well with the experimental values to provide much support for the assumption of 1- or 1,3-structures for the doubtful compounds.

A satisfactory colorimetric procedure was developed for the quantitative estimation of small amounts of azulene compounds.

1-Methylazulene was synthesized from 1-indanone, and the bromination and acetylation of 1-methylazulene were investigated. 1-Methylazulene was abandoned as a model compound for the study of the alkylation of azulene when intensive investigation revealed no satisfactory method of separating it from azulene in mixtures.

A single synthesis from indene gave an over-all yield of crude azulene of slightly less than 2%, as compared with an optimum over-all yield of nearly 7% by the more involved procedure starting with 2-naphthol.

In connection with the latter synthesis, studies on the ozonolysis of (9,10)-octalin provided the basis for an improved method which gave consistently good yields of 1,6-cyclodecanedione.

Numerous attempts to reduce diacetylazulene to diethylazulene all ended in failure.

An improved method for the nitration of azulene was developed, and a product believed to be 1,3-dinitroazulene was obtained by nitration of 1-nitroazulene.

For all the new azulene compounds prepared, the infrared, visible, and ultra-violet absorption spectra were obtained.

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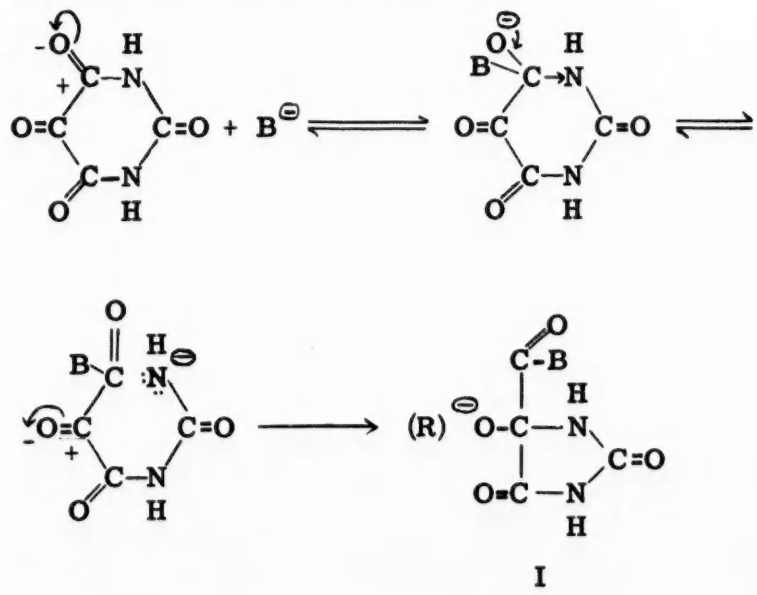
A STUDY OF ANIONIC CLEAVAGE REACTIONS OF ALLOXAN

(Publication No. 5587)

Frank Robert Fisher, Ph.D.
University of Pennsylvania, 1953

Supervisor: A. R. Day

The objective of this investigation was to study the reactions of anhydrous alloxan with alkoxides and alloxan monohydrate with secondary amines. A review of the literature has shown that only strong bases, namely the alkalies, have been reported to cleave the alloxan ring. Weak nitrogenous bases, such as urea, primary aliphatic amines and aromatic amines, did not disrupt the alloxan structure. A mechanism, which would account for the previously reported changes and which could be used to predict the reaction products of alloxan and alkoxides or secondary amines, was formulated.



I

The sodium salt of methyl alloxanate (I, R=Na, B=OCH_3) was obtained when anhydrous alloxan and sodium methoxide were allowed to react. A determination of the structure of this substance was accomplished by treatment with hydrogen chloride in an inert solvent. The product was identified as methyl alloxanate (I, R=H, B=OCH_3), a known compound. The reaction of sodium ethoxide or sodium butoxide and anhydrous alloxan gave a product which did not analyze correctly for the sodium salt of the respective ester. However, treatment with hydrogen chloride in an inert solvent yielded the corresponding ester after primary deposition of a gummy substance which was shown to be alloxan. It was therefore concluded that the substance is complex consisting partly of a sodium salt of the ester.

In contrast to the action of primary amines, secondary amines were found to cleave alloxan to form amides of alloxanic acid. 1-Alloxanoylpiperidine

(I, R=H, B=-N⬡) monohydrate was prepared by

mixing equimolecular amounts of alloxan monohydrate and piperidine in water followed by dilution with ethanol. This amide was also prepared by reacting methyl alloxanate and piperidine in an aqueous solution. The monohydrates of 4-alloxanoylmorpholine, 1-alloxanoylpyrrolidine and N,N-dimethylalloxanamide were prepared in a similar manner. The reaction of secondary amines with alloxan in an aqueous medium offers an easy direct method to obtain N-disubstituted amides of alloxanic acid.

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A STUDY OF ANIONIC CLEAVAGES OF ESTERS OF TRICHLORO AND TRIFLUOROACETIC ACIDS

(Publication No. 5601)

Madeleine M. Joullié, Ph.D.
University of Pennsylvania, 1953

Supervisor: A. R. Day

It has been found that esters of trichloroacetic acid and trifluoroacetic acid react in distinctly different ways with primary amines and with secondary amines. With primary amines, cleavage of the carbon-oxygen bond occurred giving the typical end-products of an aminolysis reaction, namely an amide and an alcohol. When 1,2-diamines were used, the ethyl ester of trichloroacetic acid formed derivatives of dihydroimidazole. Ethyl trifluoroacetate, however, reacted with 1,2-diamines to form only the diamide, no dihydroimidazole being formed.

Secondary amines reacted with the esters of both trichloroacetic acid and trifluoroacetic acid to give typical haloform reactions. In these cases a carbon-carbon bond was cleaved to form a haloform and a urethane.

Mechanisms have been proposed to account for the different behaviors of primary and secondary amines in these reactions.

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RESTRICTION OF TAUTOMERISM IN THE TRIAZOLE SYSTEM BY HYDROGEN BONDING. THE CASE OF 4(7)-NITROBENZOTRIAZOLE

(Publication No. 5608)

Norman Lee Miller, Ph.D.
University of Pennsylvania, 1953

Supervisor: E. C. Wagner

The purpose of this investigation was to study the restriction of tautomerism in the triazole structure. The compounds used in this study are the isomeric nitrobenzotriazoles, 4(7)-nitrobenzotriazole and 5(6)-nitrobenzotriazole. In 4(7)-nitrobenzotriazole the structure permits chelation, which tends to obstruct tautomeric shift: 5(6)-nitrobenzotriazole is not capable of chelation and should show the normal properties of the triazole system. Evidences for chelation were found in the comparative results for the two isomeric nitrobenzotriazoles with respect to volatility, polarographic reduction, catalytic ease of reduction, potentiometric titrations, ultraviolet spectra and association (molecular weight).

Chelation in 4(7)-nitrobenzotriazole causes the compound to be more volatile than the 5(6)-isomer. It sublimes more readily, is steam volatile, and is more volatile from hot solutions.

Hydrogen bonding in 4(7)-nitrobenzotriazole, between an oxygen atom of the nitro group and the hydrogen atom of the imino group, leads to more rapid polarographic reduction than in 5(6)-nitrobenzotriazole. The influence of chelation on the structure of the nitro group would be expected to increase the rapidity of reduction.

Conclusions of previous studies indicated that the chelated isomer would reduce more readily, but the catalytic hydrogenation of nitrobenzotriazoles gives opposite results. The reason for this apparently aberrant outcome, and its significance (if any) with respect to chelation, are not known.

The acid strength of 4(7)-nitrobenzotriazole is lower than that of 5(6)-nitrobenzotriazole, leading to the conclusion that in 4(7)-nitrobenzotriazole chelation interferes with the release of the acidic hydrogen.

Ultraviolet spectra of the isomers uncovered no evidence for chelation. The absorptions due to unsaturation in 5(6)-nitrobenzotriazole are different from those of 4(7)-nitrobenzotriazole and may be due to structural features common to both isomers rather than to the presence of chelation in 4(7)-nitrobenzotriazole.

Intramolecular hydrogen bonding leads to little or no change in the molecular weight of 4(7)-nitrobenzotriazole when determined by a cryoscopic molecular weight study. The 5(6)-nitrobenzotriazole associates through intermolecular hydrogen bonds and the molecular weight increases with increased concentration.

This comparative study of the isomeric nitrobenzotriazoles leads to the conclusion that tautomerism in 4(7)-nitrobenzotriazole can be partially restricted through chelation.

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STUDIES IN THE ISOCAMPHANE SERIES

(Publication No. 5713)

Randolph Perry, Jr., Ph.D.
University of Michigan, 1953

The aims of this study are:

1. The preparation of optically active camphene in a manner which lends itself to the labelling of the molecule at the 8-position with C^{14}.

2. The testing of the Nametkin hypothesis by use of the radioactive tracer technique.

3. The acquisition of quantitative data for the purpose of elucidating the mechanism of the racemization of camphene.

By means of the Schmidt reaction on endo-camphenilyl methyl ketone followed by hydrolysis of the resulting acetamide, endo-camphenilylamine is prepared. This amine is then resolved by fractional recrystallization of the primary salt formed with either (+) tartaric acid or (+) camphoric acid. The resolved amine is then converted to optically active camphenilone by means of a modified Sommelet reaction. In one case, optically pure camphenilone is achieved. By means of a Grignard reaction employing C^{14}-labelled methyl iodide, the optically active camphenilone is converted into methylcamphenilol and thence by way of the xanthate ester dehydration to optically active camphene labelled in the 8-position.

Racemization by standard rearrangement procedures affords camphene which is shown by ozonolysis and analysis of the resulting dimethylnorcampholide to have the isotopic carbon statistically distributed among the 8, 9 and 10-positions.

It is concluded that the racemization occurs by one or the other of two processes:

1. By migration of one of the gem methyl groups, in accord with the Nametkin hypothesis, and an alternate process not involving methyl migration.

2. By methyl migration only, in which case it is not the trans methyl group that moves exclusively.

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SUBSTITUTION REACTIONS OF BENZO(C)CINNOLINE

(Publication No. 5497)

Philip Randolph Ruby, Ph.D.
State University of Iowa, 1953

Substitution reactions of benzo(c)cinnoline have never been reported. It is of interest, therefore, to study two typical reactions, nitration and bromination.

Nitration of benzo(c)cinnoline with mixed sulfuric and nitric acids at 0° gives 1-nitrobenzo(c)cinnoline melting 160-1° in 57.7% yield and X-nitrobenzo(c)cinnoline melting at 230° in 12.1% yield. Identification of 1-nitrobenzo(c)cinnoline was accomplished by a series of reactions which started with 1-nitrobenzo(c)-cinnoline, went through 1-benzenesulfonamidobenzo(c)-cinnoline and 2,2'-diamino-6-benzenesulfonamidobiphenyl, and ended with 2-benzenesulfonamidobiphenyl whose ultra violet spectra and melting point were identical to that of the authentic compound. A mixed melting point of the authentic and derived 2-benzenesulfonamidobiphenyl showed no depression. The authentic compound was prepared from benzenesulfonyl chloride and authentic 2-aminobiphenyl.

The minor nitration isomer has not been definitely identified, but may be the expected isomer, 3-nitrobenzo(c)cinnoline.

Bromination of benzo(c)cinnoline was not effected with polar bromination methods. In this respect, benzo(c)cinnoline is similar to pyridine. It may be that this inertness to bromine is the result of the complexing ability of the azo group. Various complexes of bromine and benzo(c)cinnoline are readily prepared by refluxing appropriate amounts of the two reactants in an inert solvent. These complexes are stable upon standing, but may be decomposed with aqueous sodium bicarbonate or sodium sulfite. Complexes with 1 bromine atom per two benzo(c)cinnoline molecules and with 4 bromine atoms per benzo(c)cinnoline molecule are typical examples of the complexes isolated. Efforts to brominate with the complexing power of the azo group hindered or destroyed by use of aluminum chloride, hydrogen bromide, or strong acid solvent were of no avail.

Reduction of 2,6,2',6'-tetranitrobiphenyl with many common chemical reagents used to prepare azo groups did not result in the formation of the expected 4,5,9,10-tetrazapyrene. Less common reagents used to form azo groups, such as lithium aluminum hydride, Raney nickel, ferrous oxalate, and triethyl phosphite, also did not give the expected product.

A good route to 2,6,2',6'-tetranitrobiphenyl has been established involving an Ullmann reaction on 2,6-dinitrochlorobenzene.

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CHEMISTRY, PHARMACEUTICAL

THE PREPARATION OF ANALOGS OF DEMEROL, AMIDONE AND ISOAMIDONE AND THE REACTION OF CERTAIN NITRILES WITH GRIGNARD REAGENTS

(Publication No. 5752)

Eu-Phang Tsao, Ph.D.
University of Michigan, 1953

Two seven-membered-ring homologs of Demerol, 1-methyl-4-phenyl-4-carbethoxyhexamethylenimine (I) and 1-ethyl-4-phenyl-4-carbethoxyhexamethylenimine (II), were prepared. There were also obtained one analog of Amidone and three analogs of Isoamidone which contain the radicals of hexa- or heptamethylenimine: 4,4-diphenyl-6-(1-hexamethylenimino)-3-heptanone (III), 4,4-diphenyl-5-methyl-6-(1-hexamethylenimino)-3-hexanone (IV), 4,4-diphenyl-5-methyl-6-(1-heptamethylenimino)-3-hexanone (V) and the cyclic analog, 1,1-hexamethylene-2,5-dimethyl-4,4-diphenyl-3-ketopiperidinium bromide (VI).

The manner in which these compounds were synthesized is outlined below.

Interaction of α-phenyl-α-(β-dimethylaminoethyl)acetonitrile with trimethylene chlorobromide and sodamide yielded α-phenyl-α-(β-dimethylaminoethyl)-α-(γ-chloropropyl)acetonitrile which cyclized to form 1-methyl-4-phenyl-4-cyanohexamethylenimine methochloride (VII). Pyrolysis of VII yielded the corresponding tertiary amine (VIII). Upon hydrolysis and esterification of VIII, 1-methyl-4-phenyl-4-carbethoxyhexamethylenimine (I) was produced. Compound I was reduced by lithium aluminum hydride to 1-methyl-4-phenyl-4-(hydroxymethyl)hexamethylenimine (IX), a substance which was also obtained by the following reactions.

4-Phenyl-4-carbethoxycyclohexanone $\xrightarrow[HCl]{NaN_3}$ δ-phenyl-δ-carbethoxy-ϵ-caprolactam $\xrightarrow{LiAlH_4}$ 4-phenyl-4-(hydroxymethyl)hexamethylenimine

$\xrightarrow[2.\ LiAlH_4]{1.\ CCl_3CHO}$ IX.

Compound II was obtained by a similar series of reactions from α-phenyl-α-(β-diethylaminoethyl)-acetonitrile, trimethylene chlorobromide and sodamide. An intermediate, 1-ethyl-4-phenyl-4-cyanohexamethylenimine, was synthesized also from phenylacetonitrile, ethyl-(β-chloroethyl) (γ-chloropropyl)amine and sodamide.

In order to obtain compound III, IV and V, diphenylacetonitrile was condensed with sodamide and β-(1-hexamethylenimino)propyl chloride, and in another experiment with β-(1-heptamethylenimino)propyl chloride. In each instance the reaction product consisted of a mixture of nitriles analogous to Amidone and Isoamidone. The individual nitrile hydrochlorides were separated by the use of isopropyl alcohol. The structure of each nitrile was proven by exhaustive methylation. The final products (III, IV and V) were prepared by interaction of the required nitrile with ethylmagnesium bromide.

Bromination of the hydrobromide of IV yielded 2-bromo-4,4-diphenyl-5-methyl-6-(1-hexamethylenimino)-3-hexanone hydrobromide, a substance which, upon treatment with ammonia water, cyclized to form VI.

When 2,2-diphenyl-3-methyl-4-(1-heptamethylenimino)butyronitrile was allowed to react with ethylmagnesium bromide, the expected ketone (V) was obtained in 46% yield. In addition, 1,1-diphenyl-2-methyl-3-(1-heptamethylenimino)propane was isolated as a by-product. A study of the interaction of nitriles with Grignard reagents led to the interesting discovery that after carbonation of the reaction mixture obtained from diphenylacetonitrile and ethylmagnesium bromide, diphenylmalonic acid was formed in 55% yield.

Pharmacological tests in the Parke, Davis and Company laboratories showed that compound I is toxic and has low analgesic activity. Compound III is toxic. The other compounds are under investigation.

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CHEMISTRY, PHYSICAL

DISSOLUTION OF COPPER IN CARBON TETRACHLORIDE-AMINE SYSTEMS

(Publication No. 5574)

George J. Beichl, Ph.D.
University of Pennsylvania, 1953

Supervisor: John G. Miller

In the present investigation it has been shown that metallic copper dissolves in mixtures of aniline and carbon tetrachloride at room temperature but is insoluble in the liquids separately. The initial rate of dissolution of metallic copper is proportional to the concentration of the aniline in solutions containing excess carbon tetrachloride. In solutions containing excess aniline, the rate of dissolution of the copper is initially low, (induction period), after which the rate increases to an approximately equal value in solutions of varied compositions.

Both metallic copper and cuprous salts are effective in causing the mixture to polymerize at room temperature. If powdered copper is added in sufficient quantity, a vigorous explosion occurs.

These phenomena are explicable on the basis of free-radical intermediates. An N-chloro compound is postulated to account for the polymerization which occurs, as also the dissolution of the copper. To lend credence to the free-radical hypothesis, it is noted that carbon tetrachloride is an active participant

in the reaction, whereas if chloroform is substituted for the tetrachloride, the reaction is sluggish.

Oxygen accelerates the reaction appreciably in excess carbon tetrachloride. This can be explained on the basis of peroxide formation. The accelerating effect of dioxane is attributed to the stability of the complex copper-aniline chloride in this solvent.

Copper also dissolves more readily in concentrated aqueous ammonia if in contact with carbon tetrachloride. Evolution of gas occurs in the carbon tetrachloride layer and positive test for chloride is is obtained in the aqueous layer. Chloroform is also less reactive than carbon tetrachloride in this reaction. The formation and decomposition of chloramine as an intermediate accounts for the products obtained.

Copper dissolves readily in piperidine-carbon tetrachloride systems. After several minutes have elapsed during which piperidine hydrochloride is crystallizing from the solution, a sudden exothermic reaction occurs, converting the contents of the tube to a dark brown solid.

Chloroform is relatively unreactive compared with carbon tetrachloride, and likewise diethylamine, which has approximately the same basic strength as piperidine, is unreactive compared with the latter.

The reactivity of the piperidine is ascribed to the transient formation of N-chloro-piperidine which is very unstable.

Cupric salts are also effective in reacting with the piperidine and the carbon tetrachloride since they are readily reduced by piperidine.

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THE DIPOLE MOMENTS AND THE STRUCTURE OF SOME CONDENSATION PRODUCTS OF PRIMARY AROMATIC AMINES WITH FORMALDEHYDE

(Publication No. 5588)

Robert Adolph Florentine, Ph.D.
University of Pennsylvania, 1953

Supervisor: John G. Miller

The dipole moments of some condensation products of primary aromatic amines with formaldehyde have been determined in various solvents in an effort to determine the structure of these compounds.

When a primary aromatic amine, like aniline, is added to a slight excess of formaldehyde, a variety of products are formed. It is possible to isolate a trimer, that has been proved to be cyclic, with the formula $ArN\text{-}CH_2\text{-}N(Ar)\text{-}CH_2\text{-}N(Ar)\text{-}CH_2$. For a strainless ring a number of structural isomers are possible, including both "chair" and "boat" forms. The relationships involving the positions of the aromatic fragments increase the number of possible isomers.

The dipole moments of the various isomers have been calculated from the geometry of the molecules. For this calculation, the accepted values for the carbon and the nitrogen valence bond angles have been assumed to apply as have the established values for the bond moments involved. The calculations have included consideration of the effects of variation of the bond angles.

N-methylene aniline and N-methylene-p-toluidine have been measured in dilute solutions of benzene, carbon tetrachloride, and ligroin. The measurement involves the determination of the dielectric constant of a series of dilute solutions of varying concentrations, as well as the index of refraction and the density of this series of solutions. The Hedestrand equation was used to calculate both the dielectric polarization and the molar refraction of the solutions at infinite dilution. For the solutions in ligroin, the method of Li, Wu, and Chu was used. These measurements yielded average values of 1.16 D as the moment of N-methylene aniline, and 0.88 D for N-methylene-p-toluidine.

A comparison of the measured values for the dipole moments with those calculated indicated that the N-methylene aniline was present in these solutions as a "chair" isomer, with one phenyl group above, and two phenyl groups below the plane of the carbon atoms in the central ring. With N-methylene-p-toluidine, no such structural assignment could be made. The measured moment did not correspond to any of the calculated moments. This molecule may exist, under these conditions, as a mixture of chair and boat forms, rather than as one specific form.

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THE CRYSTAL STRUCTURE OF NICKEL SALICYLALDOXIME

(Publication No. 5863)

Charles J. Guare, Ph.D.
Indiana University, 1953

This work was carried out as part of an extensive study of the structures of organo-metallic compounds and their parent organic compounds. Nickel salicylaldoxime was chosen in this instance because previous work on this substance indicated that it would be suitable for a complete structure study by means of x-rays.

Salicylaldoxime was used to precipitate nickel from a nickel chloride solution. The precipitate was dissolved in boiling chloroform, and crystals were grown by permitting the chloroform to evaporate at room temperature.

Equi-inclination Weissenberg photographs of these crystals were taken using filtered copper radiation. The reflections on these photographs were indexed, and their intensities were estimated according to standard methods. The usual corrections were

applied to the intensities, and observed structure factors were obtained from these corrected intensities.

A trial structure of the molecule was determined in two dimensions by a Patterson projection upon (010), and subsequent Fourier projections were used to refine the "x" and "z" parameters. From a knowledge of projected bond lengths and their corresponding average actual lengths in other molecules, "y" parameters were estimated for the atoms. Three bounded projections upon (100) were tried to establish the "y" parameters more definitely, but they were unsuccessful, and so a three-dimensional Fourier summation was used. The resulting atom parameters were refined by the method of least squares, once for "x" and "z" each, and three times for "y". An anisotropic temperature factor was tried to better the agreement between the observed and calculated structure factors, but no improvement resulted, and an isotropic temperature factor was retained. For the 1298 unique observed reflections, the final value of R, which is a measure of the progress of the structure determination, was 24.3 per cent.

From the final atomic positions, bond angles and interatomic and intermolecular distances were calculated. The molecule was shown to be essentially planar, but a deviation from the square configuration of the dsp^2 bonds about the nickel atom was noted. This was explained by the existence of a short, strong oxygen-hydrogen-oxygen bond between the two organic segments of the molecule. This hydrogen bond might be symmetrical as in nickel dimethylglyoxime.

The average length of the benzene ring bonds was found to agree well with the accepted value, but the lengths of the bonds in the ring containing the nickel atom were shown to be intermediate in value between those for true single bonds and those for true double bonds which strongly indicated that resonance was taking place in that ring.

No evidence for intermolecular hydrogen bonding was found, and the intermolecular forces were assumed to be of the van der Waals type.

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THEORY OF POLAROGRAPHIC DIFFUSION: STUDY OF INSTANTANEOUS CURRENT-TIME CURVES AT THE DROPPING MERCURY ELECTRODE

(Publication No. 5542)

Sanaa Elsayed Khalafalla, Ph.D.
University of Minnesota, 1953

The theory of Polarographic diffusion is critically discussed, including the original treatment by Ilkovic, MacGillavry and Rideal and its later revision by Lingane, Loveridge and Von Stackelberg and Strehlov.

The deviation of the instantaneous current-time curve found experimentally from the theoretical equations was attributed to the neglect of the finite rate of the electrode process and to the effect of the electric double layer at the mercury solution interface upon transfer of the reducible species.

The first factor was treated quantitatively by deriving equations for the instantaneous current taking into account a finite rate of the electrode process assuming that electroreduction is a first order homogeneous process. This condition was introduced in the form of a boundary condition in the solution of the differential equation which describes the polarographic process. Another equation was derived assuming that the electrode process is a heterogeneous first order reaction and was found to give better agreement with the observed current-time provided that there is no double layer effect.

Another equation was derived for the diffusion of an ion when a second order reaction with regard to that ion occurs at the electrode surface. This equation gave better agreement with the observed current-time curve for the anodic diffusion current of potassium cyanide than the Ilkovic equation.

Also the instantaneous kinetic current of the system ferric iron and hydrogen peroxide was checked experimentally. Although the theoretical equation used in this case was also derived by P. Delahay and S. Miller, yet it did not conform satisfactorily with the observed current-time curve. However, it was found to give an average kinetic current in reasonable agreement with that found experimentally.

The double layer effect was treated qualitatively. The cathodic current-time curves for the cations cadmium and thallium were measured oscillographically at various potentials. Also the reduction of iodate and cumene hydroperoxide were investigated as examples of anions and neutral molecules respectively. The effect of maximum suppressors like gelatin, zephiran chloride and an indifferent salt like lanthanum chloride on the current-time curves was also investigated. The assumption made in the formulation of the double layer effect proved to be in qualitative agreement with the experimental results.

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THE EFFECT OF ULTRAVIOLET IRRADIATION ON THE PHOTOCHEMICAL CHANGES OF ERGOSTEROL AND THE CHROMATOGRAPHIC SEPARATION OF THE PRODUCTS

(Publication No. 5923)

James F. Kirn, Ph.D.
Michigan State College, 1953

The conversion of ether solutions of ergosterol into vitamin D and other end products was studied using ultraviolet radiation of the wavelength regions 230 mu. to 284 mu., 284 mu. to the visible, and the entire energy distribution of a "Uviarc" lamp. Other studies were carried out in the presence of

monochromatic radiation of wavelengths 254 mu., 260 mu., 265 mu., 275 mu., 281 mu., 285 mu., and 296 mu. Each reaction was carried out in an airtight quartz cell and the progress of the reaction determined by the ultraviolet absorption spectra.

To aid in the interpretation of the resulting spectra with regard to solution composition, several series of theoretical absorption curves were calculated from literature spectrographic data, for combinations of the intermediate products and ergosterol. From these curves a new series of data was calculated based on the ratio of the extinction values at a given wavelength to the extinction value of the curve considered at 281 mu. This value was plotted against increased concentrations of one of the components at a given wavelength. The slope of the resulting curves are characteristic of build up trends during irradiation. From these data it is possible to estimate the composition of the irradiated solutions.

The composition of the irradiated solutions are discussed with respect to wavelength of the activating energy.

The sensitivity of ether and ethanol solutions of calciferol in ultraviolet radiations was studied at wavelengths 254 mu., 265 mu., 281 mu., and 296 mu. The destruction was followed through the ultraviolet absorption exhibited by these solutions at 265 mu. It was found that in ether solutions, the calciferol was more rapidly destroyed than was calciferol in ethanol and in general the rate of breakdown was greater with the shorter wavelength radiation.

The separation of pure calciferol by chromatographic procedures was studied using two types of adsorbents, a diatomaceous earth, "Superfilterol," and alumina. The solutions separated consisted of irradiated ergosterol which had been irradiated under varying conditions of cell dimensions, wavelength of activating energy, and the atmosphere of the covering gases to determine how these conditions, through alteration of the composition of the irradiated ergosterol solutions, would affect the separation.

The cell dimensions were varied from 10 cm. to 0.27 mm., the radiation consisted of either the complete spectrum of a "Uviarc" mercury lamp or the radiation from this lamp filtered by a p-xylene solution, and the gas atmospheres over the solutions during irradiation was either carbon dioxide, or air. Each irradiated ergosterol solution was passed over either a "Superfilterol" column of activated alumina and the separation followed by the ultraviolet absorption curves of the eluate fractions.

In general, it was found that the "Superfilterol" divided the irradiation product into two major bands, the major constitutent of one being unchanged ergosterol and the other calciferol, tachysterol, and a compound having absorption maxima at 272 mu. and at 280 mu. Variations in relative quantities of the components were observed depending on the conditions of irradiation. Alumina achieved more complete separation of the calciferol and the compound characterized by peaks at 272 mu. and 280 mu., than was observed for "Superfilterol."

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THE KINETICS OF SOME REACTIONS RELATED TO THE DECOMPOSITION OF NITROSYL DISULFONATE ION

(Publication No. 5901)

James Chen-Min Li, Ph.D.
University of Washington, 1953

Nitrosyl disulfonate ion, $(SO_3)_2NO^{=}$, is unstable aqueous solution. It decomposes in a very complicated way to form products which are different under different conditions. The purpose of a previous initial investigation and of this work has been to try to resolve the complications into related reactions which can be studied separately and can then be combined to explain the whole situation. The following are some of the results obtained.

The spontaneous decomposition of nitrosyl disulfonate ion in 1 M sodium acetate buffer solution was found to proceed by a branching chain mechanism, that is, the rate was proportional to the amount decomposed. The first order part of the decomposition, which was observed previously by Murib and Ritter in low capacity buffer solutions, was found undetectable in this case. The intermediate compound proposed by them was found very unstable if it existed at all.

The reaction of nitrosyl disulfonate ion with nitrous acid was found zero order with respect to nitrosyl disulfonate ion and second order with respect to molecular nitrous acid. The nitrous acid was regenerated in the reaction. A mechanism was proposed, in which the formation of N_2O_3 from nitrous acid was the rate-determining step. The experimental heat of activation was found to be 20.1 kcal. and the entropy of activation 16.3 e.u.

The spontaneous decomposition of nitrosyl disulfonate ion in mildly acidic solutions was found to occur principally through the reaction with nitrous acid just described. The chain branching reaction was deduced to be first order in respect to molecular nitrous acid and zero order to nitrosyl disulfonate ion. These were confirmed through a study of the spontaneous decomposition in the presence of various amounts of added nitrous acid. The observed kinetics were applied to explain the spontaneous decomposition in unbuffered solutions.

The reaction of sulfamate ion with nitrous acid was found first order with respect to sulfamate ion, first order to molecular nitrous acid and first order to hydronium ion. The mechanism was probably that of Dusenbury and Powell, that is, between nitrosyl ion and sulfamate ion. The effects of ionic strength and temperature were consistent with this mechanism.

The sulfamate ion inhibition of the decomposition of nitrosyl disulfonate ion was discussed on the basis

of the kinetics studied. It agreed quantitatively with the experimental results obtained previously by Murib and Ritter.

The mechanism of deamination and diazotization were discussed in connection with the results obtained in reactions of nitrous acid with sulfamate and with nitrosyl disulfonate ions. Consecutive reactions were porposed for deamination to explain all the observations, in which the first step was a reversible reaction between nitrosyl ion and amine to form an intermediate, and the second step was between the intermediate and a generalized base to form nitrogen.

The spontaneous decomposition of nitrosyl disulfonate ion in alkaline solutions was found to be complicated by sulfite ion from the reversion of hydroxylamin disulfonate ion. The reaction of nitrosyl disulfonate ion with sulfite ion was found first order with respect to each substance. The effects of initial concentrations, ionic strengths and temperatures were all consistent with the mechanism proposed. The experimental heat of activation was 13.5 kcal. and the entropy of activation -18.6 e.u. in good agreement with that predicted by the theory of reactions between ions.

The reaction of nitrosyl disulfonate ion with hydrogen peroxide was found first order with respect to each substance in a buffer solution. Two nitrosyl disulfonate ions were found to react with one molecule of hydrogen peroxide to form two hydroxylamine disulfonate ions and one molecule of oxygen.

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AN ULTRASONIC INVESTIGATION OF THE PROPERTIES OF SOME LIQUID KETONES

(Publication No. 5513)

Thomas Edgar Mitchell, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor S. W. Peterson

Recent work has shown that the sound velocity is an important and useful physical property. Its potential utility in characterizing compounds is comparable to that of the refractive index or density. Of special import in this connection is the sensitivity of sound velocity to chain branching and molecular symmetry in general. A further use of sound velocity data is in the evaluation of certain quantities of thermodynamic importance. Among these are adiabatic compressibilities, ratios of specific heats, and free or available volumes of liquids.

In view of the desirability of obtaining more and improved sound velocity data, an instrument capable of measuring ultrasonic velocities with high precision was designed and constructed. This instrument consists of an improved Pierce acoustic interferometer with its supplementary electrical circuits. Factors affecting the accuracy of the sound velocity measurements such as temperature and purity of the sample, frequency of the sound wave, and calibration of the device used to measure the sonic wave length were carefully controlled and/or checked.

Sound velocities, refractive indices, and densities were measured for a series of twenty-five liquid ketones. It was found that a plot of sound velocity versus the square root of the molecular weight was linear for the methyl n-alkyl and the phenyl n-alkyl ketones studied. A tentative explanation for this unusual result is proposed.

It is suggested that the equation defining the molar sound velocity be changed from $R = \frac{v^{\frac{1}{3}}m}{d}$ to $R = \frac{v^{\frac{1}{3}}m}{d} - 45$. New values are proposed for the contributions of various atoms and structural features to the molar sound velocity. These new values lead to improved agreement between calculated and observed molar sound velocities.

The molar sound velocities, molar refractions, ratios of specific heats, Van de Waals' "b"'s, molecular weights, and adiabatic compressibilities are calculated for these ketones.

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A STUDY OF THE SYSTEMS Na-Hg AND NH_4-Hg BY X-RAY DIFFRACTION

(Publication No. 5488)

James Willard Nielsen, Ph.D.
State University of Iowa, 1953

Five sodium-mercury compounds, $NaHg_4$, $NaHg_2$, NaHg, Na_3Hg_2 and Na_5Hg_2, were prepared and examined by X-ray diffraction.

The structure of $NaHg_2$ was determined from a powder diagram to be the aluminum boride structure. The hexaginal cell has the following dimensions: $\underline{a} = 5.029$ Å.; $\underline{c} = 3.2304$ Å. The cell volume is 70.7 Å^3.; the calculated density is 9.96 g/cm^3; the observed density is 9.94 g/cm^3. The closest mercury-mercury distance is 2.90 Å.; the sodium-mercury distance is 3.16 Å.; and the sodium-sodium distance is 3.23 Å.

The crystal structure of NaHg was determined from single crystal Weissenberg (hkO) and Buerger precession camera (Okℓ) data obtained with Mo K_α radiation. The unit cell is orthorhombic with the dimensions:

$\underline{a} = 7.19$ Å.; $\underline{b} = 10.79$ Å.; $\underline{c} = 5.21$ Å.

The volume of this cell is 404 Å^3.; and it contains eight units of NaHg. The calculated density is 7.36 g/cm^3. The observed density is 7.26 g/cm^3. The space group is D_{2h}^{17} - Cmcm. Approximate

mercury parameters obtained from a Patterson projection using (hkO) data were refined by Fourier projections using (Okℓ) and (hkO) data. The mercury atoms are located in 8 (g) from Cmcm. The parameters are x = 0.209; y = 0.087. The sodium atoms are in two positions 4 (c) from Cmcm with the parameters y = 0.359; 0.819. The reliability factor is 0.20. The closest mercury-mercury distance is 3.00 Å.; the closest mercury-sodium distance is 3.18 Å.; the closest sodium-sodium distance is 3.28 Å.

The partial structures of Na_3Hg_2 and what is believed to be Na_5Hg_2 were determined using data obtained with the Buerger precession camera and the Weissenberg camera employing Mo K_a and Cu K_a radiation respectively.

In the case of Na_3Hg_2 the unit cell was tetragonal:

$$a = 8.52 \text{ Å.} \qquad c = 7.80 \text{ Å.}$$

The cell volume is 566 $Å^3$, occupied by four units of Na_3Hg_2, indicating a density of 5.51 g/cm^3. The observed density is 5.55 g/cm^3. Three space groups were found to be equally probable considering only (hkO) data: D_{2d}^8 - $P\bar{4}n2$, D_{4h}^{14} - $P4_2/mnm$ and C_{4v}^4 - $P4_2nm$. The set 8 (j) from $P4_2/mnm$ with x = 0.125 gives excellent agreement between calculated and observed structure factors of the (hkO) data. The reliability factor considering only mercury contributions is 0.12. The sodium atoms were placed in 8 (h) and 4 (g) with x = 0.148. R calculated using both Hg and Na contributions was 0.14. The xy positions are nearly correct, but the z parameters were undetermined. Closest mercury-mercury distance is 3.12 Å.

Precession camera data from a crystal thought to be Na_5Hg_2 indicated a rhombohedral unit cell: a = 18.52 Å., = 60° 56′. The volume of this cell is 1352 $Å^3$. By assuming a hexagonal pseudo-cell one third the volume of the rhombohedral cell, and by placing the mercury atoms in special positions in this cell it is possible to explain the observed intensities qualitatively. These positions referred to the rhombohedral lattice are (e), (c) and (b) from D_{3d}^6 - $R\bar{3}c$ where x = 11/12, and 1/6, in (e) and (c) respectively.

The unit cell of $NaHg_4$ is very large. It is hexagonal with the following dimensions:

$$a = 61.4 \text{ Å}, \qquad c = 9.7 \text{ Å.}$$

X-ray powder diagrams were obtained at -190° C from ammonium amalgam prepared by allowing $NaHg_4$ to react with ammonium iodide in liquid ammonia. Powder diagrams were also taken of water and mercury at -190° C. Lines appeared in the ammonium amalgam films which could not be explained as arising from water, mercury, or any known impurity, but which also could not necessarily be attributed to ammonium amalgam.

Unexplainable lines also appeared in the diagram of pure mercury.

The crystal structures of ZrBeSi and $ZrBe_2$ have been completed. ZrBeSi has a "Filled" nickel arsenide structure. The hexagonal cell has dimensions: a = 3.71 Å.; c = 7.19 Å. $ZrBe_2$ is isostructural with AlB_2. The cell dimensions are: a = 3.82 Å; c = 3.24 Å.

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THE CRYSTAL AND MOLECULAR STRUCTURE OF TETRABORANE

(Publication No. 5550)

Christer Eric Nordman, Ph.D.
University of Minnesota, 1953

The crystal structure of tetraborane, B_4H_{10}, has been determined by single crystal x-ray diffraction methods, using 616 observed reflections. There are four molecules in a monoclinic unit cell having parameters a = 8.68, b = 10.14, c = 5.78 Å and $\beta = 105.9°$ giving a calculated density of 0.725 $g.cm^{-3}$. The space group, $P2_1/n$, is unambiguous, and the twelve independent positional parameters of the boron atoms were determined from three-dimensional Fourier syntheses. The hydrogen atoms were readily observable, and were also located more precisely from a three-dimensional Fourier series from which the boron atoms had been subtracted.

No molecular symmetry elements are required by the space group of the crystal, but the molecular dimensions indicate that the symmetry of the isolated molecule is C_{2v}. The boron atoms form two triangles, $B_IB_IB_{II}$, with a common edge, B_I-B_I, the angle between the planes of the triangles being 118.1°. One hydrogen atom is attached to each of the two boron atoms B_I, and two are attached to each of the two boron atoms B_{II}. The remaining four hydrogen atoms form bridges between the four pairs of boron atoms B_I-B_{II}. Molecular parameters are four B_I-B_{II} = 1.845 ± 0.002 Å, B_I-B_I = 1.750 Å, B_{II}-B_{II} = 2.786 Å, six B-H = 1.11 ± 0.04, four B_I-H(bridge) = 1.37 ± 0.10Å, including their average deviations on the assumptions that the molecular symmetry is C_{2v}, and that all six B-H distances are equal.

The interpretation of the Patterson function is discussed with reference to the existence of a "false solution," which, while incorrect, gives a reasonably good agreement with the experimental evidence.

A disordered, metastable modification has been obtained by instantaneous crystallization of supercooled, liquid B_4H_{10}. This phase has two molecules in a hexagonal unit cell with the parameters a = 5.79 and c = 9.36 Å, giving a calculated density of

0.65 g.cm^{-3}. The space group is $C6_3/mmc$. The individual molecules are randomly oriented about their centers, and the structure is that of a hexagonal close packing of spheres.

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THE KINETICS OF THE REACTION BETWEEN NITROGEN DIOXIDE AND FLUORINE

(Publication No. 5811)

Richard Leroy Perrine, Ph.D.
Stanford University, 1953

The rate of the reaction between nitrogen dioxide and fluorine to form nitryl fluoride:

$$2NO_2 + F_2 \longrightarrow 2NO_2F$$

has been measured at 27.7, 50.4, and 70.2°C. Successful runs were made in a 22 liter Pyrex flask, with concentrations of reactants between 5 and 200 x 10^{-9} moles/cc. Light absorption by NO_2 was used to follow the reaction.

F_2 was prepared by the electrolysis of a fused KF.2HF mixture at 98° C with carbon anodes, and purified by fractionation. The generator, similar to others described in the literature but with several improvements, delivered 2 liters at S.T.P. per hour with a minimum of attention. Cylinder NO_2 was purified before use.

A stainless-steel reaction cell was constructed and found unsuitable for quantitative work with F_2 above 200° C due to flaking of the protective fluoride layer. Also, NO_2 adsorbed strongly on fluorinated stainless steel. To permit use of the absorptiometric method, a technique was developed to seal quartz tubes containing magnesium fluoride coated windows to stainless steel. The windows were found vacuum and pressure tight, resistant to fluorine, and adaptable for high temperature work.

A measured pressure of NO_2 was injected into the Pyrex flask from a glass pipet system, and the concentration again measured by light absorption. F_2 from a stainless-steel storage bulb was rapidly injected into the pipet system and released into the reaction flask with the start of the run. Timed light intensity readings determined the rate of disappearance of NO_2. F_2 was determined by difference, using initial and final NO_2 concentrations and the stoichiometry of the reaction. Pyrex, and the Halocarbon stopcock grease used, appeared unaffected by short exposure to small quantities of dry fluorine.

The reaction was found to be complete, and by variation of initial concentrations, first order with respect to each reactant. No dependence on NO_2F was observed, thus:

$$\text{Rate} = -\frac{d(F_2)}{dt} = k(NO_2)(F_2)$$

The integrated equation fitted to the data gave values for the empirical constant k at the three temperatures. Least squares fit of the individual constants to the Arrhenius equation gave as the mean value:

$$k = 1.59 \times 10^{12} \exp -\frac{10470}{RT} \text{ cc moles}^{-1} \text{ sec}^{-1}$$

For this equation in the logarithmic form to the base 10, the intercept and its standard deviation are 12.203 + 0.125, the energy of activation is 10.470 $\pm$ 0.185 kcal/mole, and the standard deviation from the mean of the logarithm of a single empirical constant is $\pm$ 0.044, corresponding to 11% of the mean value.

By comparison of derived rate expressions with the observed dependence on reactants, possible mechanisms were eliminated. The two remaining included as steps:

$$(1)\quad NO_2 + F_2 \xrightarrow{k_1} NO_2F + F$$

followed by one of:

$$(2)\quad F + NO_2 + M \xrightarrow{k_2} NO_2F + M$$
$$(3)\quad F + F + M \xrightarrow{k_3} F_2 + M$$

Statistical mechanical calculation of equilibrium constants and reasonable approximation of rate constants for the unimolecular dissociations that are the reverse of (2) and (3) indicated step (2) to be at least 10^9 times as fast as (3), and that step (3) would require unreasonably large concentrations of fluorine atoms. Thus steps (1) and (2) constitute the mechanism, from which:

$$\text{Rate} = -\frac{d(F_2)}{dt} = k_1(NO_2)(F_2)$$

and the empirical constant is that for the elementary bimolecular step (1).

From experience gained in this investigation, a magnesium cell construction is suggested which should be suitable for work with fluorine at temperatures to 350° C, and pressures from 0.01 to 10 atmospheres.

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STREAMING POTENTIAL STUDIES OF PHOSPHORS, GLASSES AND GELS

(Publication No. 5621)

George L. Schnable, Ph.D.
University of Pennsylvania, 1953

Supervisor: J. F. Hazel

The purpose of this study was to obtain information concerning the zeta potentials of phosphors and glasses in contact with various solutions that are employed in promoting adhesion of phosphors to glass in cathode-ray screens.

An improved streaming potential apparatus employing reversible calomel electrodes was devised. By application of equal pressure to each side of one of the salt bridges many of the difficulties involved with the use of calomel electrodes for streaming

The zeta potentials of Corning #7740 glass (chemical Pyrex), Corning #9010 glass, silicized du Pont #1629 phosphor (a silicized zinc sulfide - zinc cadmium sulfide phosphor), du Pont #1630 phosphor (a zinc sulfide - zinc cadmium sulfide phosphor), R.C.A. #33-Z-8 phosphor (a zinc beryllium silicate phosphor) and of silicic acid were determined in distilled water and in various potassium chloride solutions.

The isoelectric point of silicic acid, determined with hydrochloric acid solutions, occurred at a pH of 1.9.

Potassium silicate solutions, prepared from Kasil #1 (Philadelphia Quartz Company; a potassium silicate solution; 7.8% K_2O, 19.5% SiO_2; molecular ratio, 3.37), were very effective in charging the above described phosphor and glass surfaces negatively. With the phosphors a maximum in the zeta potential-concentration curve occurred at less than 0.1% by volume Kasil #1. The zeta potential-concentration curves for the glasses had maxima at about 0.5% by volume Kasil #1.

Both glasses were negative in dilute barium acetate solutions. The zeta potential of Corning #9010 glass was slightly higher in barium nitrate solutions than in barium acetate solutions, due to the influence of the anions.

Addition of barium acetate to potassium silicate solutions caused a substantial reduction in the zeta potential of the phosphor or glass in the silicate solution. Relatively small amounts of barium acetate, in the order of a few hundred p.p.m., reduced the zeta potentials of the solid surfaces considerably.

The magnitudes of the negative zeta potentials of Corning #9010 glass and of du Pont #1630 phosphor in potassium silicate solution and in potassium silicate-barium acetate mixtures decreased with time. The change of zeta potentials with time was attributed to solubility of the solid, swelling of the solid, and base exchange.

A considerable decrease in the rate of flow of certain potassium silicate-barium acetate mixtures through the streaming cell, as compared to flow rate of previous solutions through the same streaming cell under the same pressure differential, occurred with many of the streaming cells used. This phenomenon was shown to be due to the formation of silica gel on the surface of the particles of glass or phosphor in the streaming cell. An equation was derived which showed that in cases where flow rates less than about 10% of normal were observed, practically all of the pressure differential existed across the silica gel and hence the zeta potential calculated corresponded to that of the silica gel.

The relative repulsion of phosphor and glass can be estimated from curves of the product of their zeta potentials versus electrolyte concentration. For Corning #9010 glass and du Pont #1630 phosphor in 0.6% by volume Kasil #1, a concentration commonly used in the preparation of cathode-ray screens, the zeta potential product was about +4500 mv^2. Addition of 100 p.p.m. barium acetate monohydrate to this solution lowered the product to about +1100 mv^2. When about 150-200 p.p.m. barium acetate monohydrate was added, the surfaces of the glass and phosphor became coated with silica gel. The zeta potential product for the two surfaces, each coated with silica gel, was about +200 mv^2.

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THERMODYNAMICS OF ION PAIR FORMATION IN SOME NON-AQUEOUS SOLVENTS

(Publication No. 5850)

Kurt H. Stern, Ph.D.
Clark University, 1953

In order to investigate ion-solvent interactions in low dielectric constant solvents, ion conductances of the symmetrical tetralkylammonium picrates in which the number of carbon atoms was varied from four to twenty, were measured in ethylene chloride at 5° and 35° C, and the conductances of tetrabutylammonium picrate in ethylidene chloride and propylene chloride at these temperatures and at 25° C were also measured. From the data obtained dissociation constants of the ion pairs and thermodynamic functions were calculated.

The change in Λ_o, the conductance at infinite dilution, with temperature, was accounted for by the change in solvent viscosity. At all three temperatures dissociation constants are about five times as great in ethylene chloride as in ethylidene chloride, and nine times as great as in propylene chloride. For each salt studied ΔS° and ΔH° were constant over the tempreature range. The thermodynamic functions are tabulated below.

THERMODYNAMIC FUNCTIONS

Salt	ΔF° (Kcal/mol)	ΔH° (Kcal/mol)	ΔS° (e.u.)
A. Ethylene Chloride			
Me_4NPi	6.15	- 5.66	- 39
Et_4NPi	5.18	- 3.31	- 28
Pr_4NPi	5.05	- 3.39	- 28
Bu_4NPi	4.95	- 2.35	- 25
AM_4NPi	4.93	- 2.30	- 24
B. Ethylidene Chloride			
Bu_4NPi	5.93	- 2.96	- 30
C. Propylene Chloride			
Bu_4NPi	6.29	- 1.80	- 27

The results obtained are interpreted in terms of a three-step reaction for the dissociation of a solvated ion pair.

(1) $[AB]^\circ (Y)_x \rightleftharpoons [AB]^\circ + xY$

(2) $[AB]^\circ \rightleftharpoons A^+ + B^-$

(3) $A^+ + B^- + (z_+ y)\, Y \rightleftharpoons A^+ (Y)_z + B^- (Y)_y$

where y refers to the solvent molecules. Since H_2 is always positive, and since it is reasonable to assume that $\Delta H_1 << \Delta H_3$, the sign and magnitude of ΔH_3 determines the sign of ΔH°.

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THE CONDUCTANCE OF ALKALI METALS IN THE AMINES; TECHNIQUES AND STABILITY FACTORS

(Publication No. 5630)

Joseph Varimbi, Ph.D.
University of Pennsylvania, 1953

Supervisor: E. C. Evers

Ammonia and certain organic amines are known to dissolve the alkali and alkaline earth metals with the formation of colored, highly conducting solutions. Measurements of the physical and chemical properties of these solutions, particularly in the case of the organic amines, are difficult to make since there is a great tendency for the dissolved metal to react with the solvent to form metal amide and hydrogen according to the equation

$$2M + 2R\text{-}NH_2 = 2M(RNH) + H_2$$

As the first step in the study of the electrical and optical properties of solution of potassium in methylamine, a study was undertaken to determine the factors affecting the stability of these solutions. Techniques were developed, based on the results of this study, for the preparation and manipulations of such solutions leading to measurement of the conductance of potassium in methylamine.

The results of the investigation can be summarized as follows:

1. Of the various glasses tested as possible materials of construction of conductivity cells (Pyrex, Nonex, Vycor, soda glass, Kimble Resistance Glass, and a glass resistant to molten lithium ((the analysis of the latter glass is given))), carefully cleaned Pyrex which was given a washing with metalamine solution just prior to use proved to be the most satisfactory. Vycor was least satisfactory, and the other glasses were intermediate.

2. Electrodes were made of platinum, tungsten and molybdenum. The use of molybdenum was always accompanied by the formation of a sludge in the solution under test. Tungsten was chosen over platinum because tungsten could be sealed directly through Pyrex glass without the use of a graded seal. One of the grading glasses used for platinum seals was badly etched by the solutions. All the metals were potent catalysts for the reaction between alkali metal and amine.

3. Solvent could be satisfactorily purified by refluxing with potassium metal and then allowing the amine to remain in contact with freshly activated alumina.

4. A method was devised for sealing small, weighed samples of potassium metal into fragile glass bulbs, which could, in turn, be sealed into the conductance cell and broken in situ to give solutions of accurately known concentration.

5. A thermostat and temperature controller were designed and built which were capable of maintaining (to within 0.002^0) temperatures from -78^0 to -10^0.

6. The characteristic blue color of these solutions was observed to fade when a dilute solution of potassium in methylamine was allowed to warm from -33^0 to 25^0. This was not due to reaction of metal with solvent, for, when the solution was cooled again to -33^0, the color reappeared.

7. The measured conductance proved to be sensitive to the frequency of the applied field. This was interpreted as indicating that the electrode processes are irreversible.

8. The temperature coefficient of conductance was found to be positive and somewhat larger than would be expected from the change in the viscosity of the solvent with temperature.

9. The viscosity of methylamine was measured over the range -80^0 to -14^0 and found to obey the equation

$$\log \eta = 417.0/T - 4.247$$

10. A cell was designed which permits the preparation of a dilute solution of potassium in methylamine under conditions which minimize the reaction between metal and solvent. Solution is in contact with the tungsten metal electrodes only during a measurement. Quantities of solution may be withdrawn and replaced by weighed amounts of fresh solvent so that a series of conductance measurements may be made at successively lower concentrations.

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THE HOMOGENEOUS DECOMPOSITION OF NITRIC ACID VAPOR AT LOW PRESSURES

(Publication No. 5819)

James Rushton White, Ph.D.
Stanford University, 1953

Experimental

The vapor phase decomposition of nitric acid was studied in the concentration region $.2 \times 10^{-7}$ mole/cc to 5×10^{-7} mole/cc. A total of 172 runs were made at 374^0 C, 400^0 C, and 425^0 C. A run was carried out by expanding nitric acid vapor into a carefully thermostated, two liter Vycor bulb. The reaction was followed by observing colorimetrically the appearance of nitrogen dioxide.

Results

The reaction was found to be homogeneous (within experimental error) at 425^0 C and nearly so at the lower temperatures. The mechanism

$$HNO_3 \underset{b}{\overset{a}{\rightleftharpoons}} HO + NO_2$$

$$HO + HNO_3 \xrightarrow{c} H_2O + NO_3$$

was verified. This mechanism predicts the rate expression

$$-\frac{d(HNO_3)}{dt} = 2a\ \frac{(HNO_3)^2}{(HNO_3) + \frac{b}{c}(NO_2)}$$

The quantities a and $\frac{ac}{b}$ can be obtained from experimental data. The rate constant a is that for an elementary unimolecular reaction.

At low total concentration (M), the rate constant a was found to have the form

$$a = k_0'(M)$$

in the region $(M) < 1.7 \times 10^{-7}$ mole/cc. At 425° C a total of 54 runs were made in this concentration region and the resulting plot of a against (M) is definitely a straight line through the origin. The quantity k_0' was found to have the value

$$k_0' = 2.8 \times 10^{17} \exp\left(-\frac{38{,}300}{RT}\right)$$

In the concentration region $1.7 \times 10^{-7} < (M) < 5 \times 10^{-7}$ mole/cc, the experimental points fall somewhat below the straight line. This behavior is in accord with the predictions of the Lindemann theory.

The bimolecular rate constant c can be evaluated once the equilibrium constant

$$K = \frac{(HO)\ (NO_2)}{(HNO_3)} = \frac{a}{b}$$

has been calculated from thermodynamic data available in the literature. It was found that $c = 10^{11.2}$ cc mole^{-1} sec^{-1} with a low or zero activation energy.

Theoretical

The implicit dependence of any unimolecular rate constant k_M upon total concentration (M) is shown to be given by the relation

$$\left[\frac{k_0'(M)}{k_M} - 1\right] \qquad \left[\frac{k_\infty}{k_M} - 1\right] = J$$

where $K_0' = \lim_{(M)\to 0} \frac{k_M}{(M)}$ and $k_\infty = \lim_{(M)\to\infty} k_M$. The quantity J, which has a definite statistical interpretation, is a slowly varying and bounded function of (M). J is shown to be everywhere equal to or greater than unity.

The limiting values of J at low and at high concentrations, denoted by J_0 and J_∞ respectively, are known for nitrous oxide ($J_0 = 2.6$; $J_\infty = 3.3$) and nitrogen pentoxide ($J_0 = 11.4$; $J_\infty = 3.1$). Values of J_0 and J_∞ for nitric acid are arrived at by considering the nitric acid molecule to be a case intermediate between the nitrous oxide and nitrogen pentoxide molecules. Thus the quantity J is expected to decrease from $J_0 \approx 7$ to $J_\infty \approx 3$ as (M) increases from zero to infinity. Knowing J_0 it is possible to calculate the quantity k_∞. Hence, using only the low concentration data of the present study, the variation of the unimolecular rate constant k_M with total concentration (M) is predicted over the entire range of the variables.

Microfilm copy of complete manuscript of 83 pages, $1.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1099.

ECONOMICS, GENERAL

PROBLEMS OF INDUSTRIALIZATION IN DENSELY POPULATED UNDER-DEVELOPED COUNTRIES

(Publication No. 5460)

She-wo Chang, Ph.D.
State University of Iowa, 1953

The present economic conditions of the densely populated under-developed countries are marked by stagnation of agriculture, dominance of foreign capital in modern enterprises, and tardy growth of native industries. As a result of the decline of handicraft industry, the lack of industrial development, and natural increase in population, increasing numbers of people find themselves compelled to depend on agriculture to maintain even the low scale of living characteristic of such countries. Measures to improve such conditions appear to lie in demographic adjustment, agricultural reform and industrialization.

Demographic adjustment does not seem to be a solution which offers immediate relief. Emigration on a large scale is not likely under present international conditions and the decline of birth rates is only a "long run" possibility which industrialization itself will help to bring about.

Agricultural reform, like industrialization, is only part of a general economic evolution. Agricultural reform includes technical aspects as well as institutional aspects such as land tenure, credit and marketing facilities, and education and welfare services. Institutional reform improves the economic status of tenants and farmers, and opens the way for technical changes. Agricultural reform increases food and raw material supplies for the cities, and provides a widening market for manufactured goods. In the long run, however, agricultural progress requires the support of industrial development in the form of growing demand for farm products and the provision of production and consumption goods for farmers. In densely populated countries, agriculture also relies on industry to absorb surplus labor supply.

Industrialization, defined as a process in which secondary and tertiary industries are established and increased, tends to raise the productivity of the population and to abate under-employment of rural labor. It is a process of capital formation and of

redistribution of working population among various branches of economic activity.

Occupational shift has occurred in every progressive economy where productivity of agriculture has been raised and industries have been developed. In the densely populated under-developed countries, this shift has scarcely begun. The movement of labor from agriculture depends on rapid development of industries and the lessoning of social barriers. Improvement in labor efficiency lies chiefly in an expansion of education and training programs, extension of health and medical facilities, and betterment of working conditions.

The function of capital formation will probably be performed by governments in under-developed countries, because of the lack both of pre-industrial accumulation of wealth and of a substantial enterprising middle class. The sources of capital formation in the initial stages of industrialization will come from the increase of productivity in agriculture and later from industry. The volume of saving can be increased on an involuntary basis by taxation and inflation, and on a voluntary basis by providing improved banking and credit facilities. Capital construction in densely populated countries may also be accelerated by combining under-employed labor with relatively small amounts of material equipment. Foreign capital, although helpful, can assume only an auxiliary role.

Industrialization of the under-developed areas will probably result in an increased volume of world trade. The shifts in international specialization accompanying the process of industrialization will also pose problems of economic adjustment for these nations which have already achieved an advanced stage of industrial development.

Microfilm copy of complete manuscript of 297 pages, $3.71. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1300.

CIVIL AERONAUTICS BOARD CONTROL OVER DOMESTIC ROUTES AND COMPETITION, 1938—1952

(Publication No. 5666)

Robert Stanley Einzig, Ph.D.
University of Michigan, 1953

The purpose of this study is to determine the principles employed by the Civil Aeronautics Board in guiding the development of the domestic route network and of competition between airlines as well as to evaluate these principles in light of precedent in other regulatory areas, inner consistency and economic theory. The importance of the study arises from the facts that air transport is the first industry which has been subjected to full-scale regulation since its infancy, it is one of the most dynamic of industries, and it has been developed through use of a subsidy in the form of air mail payments.

The procedure followed was to use as original data the cases decided by the Board from its inception through 1952 and to extract from these cases significant patterns of decision-determining variables as well as the methodology used in combining these variables into the particular decision.

Chapter I analyses the technical and economic characteristics of air transport and examines the Civil Aeronautics Act of 1938. Chapter II exhibits the principles governing the expansion of routes. The most general expression of these principles is that in each case the need for new or improved service is balanced against its cost. The need is almost exclusively that of commerce and expresses itself in terms of nonmail revenues which will be obtained. The cost is the required subsidy payment by the government. Computations of the amount of support given weakly indicate the hypothesis that the Board is reluctant to support new service which will not derive sufficient nonmail revenues to cover the additional costs of rendering it.

Chapter III analyses the powers of the Board, and the actions which it has taken, to mold positively the route network. The major conclusions are that the Board's powers are very limited, advance planning would have greatly increased efficiency, and it was an error to permit intangibles to enter merger prices.

Chapter IV considers the competitive problem in certification. The Board has greatly increased the amount of effective competition through certification. The outstanding principles have been that of "balanced competition" — that one carrier must not have an overwhelming advantage over its competitors — and that of "loyalty" — that any possible conflict of interest must be prevented. The first principle has resulted in the more rapid enlargement of the smaller airlines and is partly responsible for the failure of the Board to certificate any new trunk airline since 1938. The latter principle has accounted for both the exclusion of the surface carriers from air transport and the entry of specialized carriers such as the feeder airlines, helicopter services, exclusive cargo carriers, and freight forwarders.

Chapter V summarizes and evaluates these principles. The general conclusion is that the Board has performed reasonably well but that more positive planning would have been desirable, and the haphazard enlargement of the routes of the smaller carriers has not accomplished its purpose of strengthening them. Recommendations are then made for desired changes in Board policy and legislation.

Microfilm copy of complete manuscript of 574 pages, $7.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1301.

A STUDY OF THE NATURE AND COST OF GOVERNMENT PROGRAMS AFFECTING POTATOES AND THEIR IMPACT ON INTER-MARKET RELATIONSHIPS

(Publication No. 5557)

Vernon Lyle Sorenson, Ph.D.
University of Minnesota, 1953

This study is part of a larger regional research project undertaken cooperatively by 12 north central land grant colleges, the Bureau of Agricultural Economics, and the Production and Marketing Administration with funds provided under the Research and Marketing Act of 1946. The larger study includes in addition to the phases developed here a historical analysis of production patterns in the United States potato industry with particular reference to the impact that the price support program from 1942 through 1950 had on industry development.

Three separate, though closely related phases of this larger study are presented here. First, an attempt is made to present a logically sequented and perspicuous description of the government price support and marketing programs for potatoes from 1934 through 1950. Second, analyses are made with a view toward (a) estimating the money cost to taxpayers and consumers of supporting the price of potatoes from 1942 through 1950, and (b) to assessing the long run impact of this program on resource use efficiency. Third, an attempt is made to evaluate the efficacy with which potato producers can use marketing restrictions to increase returns from their crop.

In substantial contrast with the situation which had existed during the prewar period, price supports from 1942 through 1950 were on a systematic precommittal basis. Farmers knew when planting was undertaken approximately what price would be available for the crop. In terms of the measure developed in this study, it appears that farmers responded to the price guarantee by producing larger quantities of potatoes than would have been produced at a comparable average price in the absence of guarantees. Since the analysis further indicates that demand was adequate to have maintained potato prices above support levels in the absence of program-induced shifts in the supply curve, the conclusion is reached that the price support program proved effective in reducing the average price of potatoes to consumers during the period 1942 through 1950. It is further concluded that although the gross income to producers from the sale of potatoes may have been increased by the program, the increases resulted only because larger quantities of potatoes were produced and sold with price supports than would have been the case without supports. But since these potatoes were sold at a price below free market levels it is doubtful that producer's net incomes were increased, when consideration is given to the fact that production costs were incurred in producing the additional quantities of potatoes.

If the goal of the program was to transfer income to potato producers it appears to have been inefficient in doing so. On the other hand as a method of increasing production (this was the ostensible goal when the program was originally effectuated) the program was effective. But since the use of government benefits to increase production must implicitly assume that concurrent activity will be undertaken to prevent overproduction in case of an excessive response, it must be concluded that the program was only partially effective when measured by the criterion of a goal involving production adjustment.

In the short run resources were channeled into the production of unwanted potatoes. However, it appears that potato production was organized on a more efficient basis at the end of the program than would have been the case without price supports.

Marketing agreements were not used extensively by potato producers throughout most of the price support period. Further because of the extensive nature of operations under the price support program it is impossible to discern the separate influence that market restrictions may have had. It appears, however, that no single homogeneous producing area in the United States produces a sufficient proportion of the crop to effectively increase income in the short run by market restriction.

Microfilm copy of complete manuscript of 308 pages, $3.85. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1302.

AN ECONOMIC STUDY OF THE PRODUCTION CONTROL AND PRICE SUPPORT PROGRAM FOR BURLEY TOBACCO WITH PARTICULAR REFERENCE TO KENTUCKY

(Publication No. 5562)

George Perry Summers, Sr., Ph.D.
University of Minnesota, 1953

The purposes of this investigation were to analyze the economic significance of the production control and price support program for burley tobacco during the seventeen years, 1934-1950, inclusive, and to appraise the economic value of the farm policy represented by the program. The economic benefits derived from the program, the manner in which those benefits are distributed, the costs of the program to society, and the economics of the program as a long-range farm policy are examined and are evaluated.

Descriptive and statistical techniques were applied to data on production, stocks, prices, and income from burley. Statistical techniques used include simultaneous equations and both tabular and correlation analysis. Changes in production areas and the shifting of acreages among burley growers which occurred during the seventeen years, are measured and analyzed in order to show the influence of the program on: (1) the distribution of benefits among burley growers; (2) production efficiency; and (3) economic significance of the program as a price and income policy. The economic effects of acreage controls are treated separately from the influence of direct price supports, then the effects of the two are combined for further analysis.

Burley tobacco prices were higher during the period when the production control and price support program was in effect than in a comparable period prior to controls, even after allowing for changes in the general level of prices received for farm products. Income per acre of burley produced also was higher. A higher degree of price stability prevailed during the period when the direct price support program was in effect than in any other comparable period.

The distribution of the benefits from the program is influenced by: (1) the capitalization of acreage allotments into land values and land rentals; and (2) by the reapportionment of acreage allotments among growers. Capitalization confers benefits on the growers who own the farms with allotments while the process is taking place. This results in benefits being distributed among farmers in a manner other than that intended.

The evidence indicates that the program has resulted in shifting allotments and acreages from intensive producing areas to peripheral areas and in reducing the average allotment size. This reapportionment was accomplished without apparent regard to the effect of production efficiency. The economic soundness of a policy which results in such shifts is open to question because it is conducive to inefficiencies in production, results in some maladjustment in productive resources spreads acreage into areas and to growers that lack production "know how," hampers the functioning of advantages of scale, and interferes with the functioning of the principle of comparative advantage.

Furthermore, the program has resulted in the expansion of the area of burley production to include growers with small farms, less productive land, small farm income from other sources, and are considerable distances from markets. The price and income protection afforded small, inefficient growers retards the movement of excess farm population into non-agricultural employment, limits the economic influences which make for an increase in size of farm, and provides a setting for perpetuating under-employment.

It is probable that in the long-run both burley growers and the American public would be benefited if the efficient growers were free to use their productive abilities more fully, i.e., allow comparative advantages to dictate areas of burley production and to permit production efficiency with profit motive to be the criteria in determining who would grow burley tobacco. It should be possible to accomplish these economic improvements without sacrificing the potential efficiencies gained from price stability.

Microfilm copy of complete manuscript of 190 pages, $2.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1303.

NORTHERN RHODESIA AND ITS DEVELOPMENT PLAN

(Publication No. 5753)

Jan Bruno Tulasiewicz, Ph.D.
University of Michigan, 1953

The purpose of this study is to present the Development Plan for the British Crown Colony of Northern Rhodesia, the different problems which must be solved by the development authority, and the results which may be expected from the development program carried out by the colonial government.

In order to understand the changes which are now taking place in Northern Rhodesia, Part I starts with a brief description of the country and its economy before the development plan was initiated. Next, it was necessary to stress the differences between problems of underdeveloped countries as compared with undeveloped countries. It turned out that economic literature has very little to say about the path of development which an undeveloped country should follow. Furthermore, the methods which may be used to advantage in underdeveloped regions are in general not applicable to undeveloped countries. Because the so-called "theories of industrialization" do not explain satisfactorily the causes of progress, it was attempted to introduce a new concept of progress. And because more is involved than the concept of "industrialization" ordinarily conveys, it seemed important to discuss the impact of a modern economy upon a primitive society.

Part II begins with a description of the Development Plan and its financing. Separate sections are devoted to the specific problems of agriculture, health, education, African urban housing, and secondary industries, both as to their present status, and as to the accomplishments which may be expected during the ten year period in which the plan is being carried out.

The problems confronting undeveloped countries, such as Northern Rhodesia, may be expressed in one phrase — "self-perpetuating poverty" of the native population. Unlike many of the underdeveloped countries, such as India, the completely primitive country of Northern Rhodesia does not even have the rudiments of a society which could sustain development if one started. Therefore, the creation of such a social basis is the very first problem which has to be solved.

The various development programs carried out in the past by private initiative resembled rather exploitation of the native population than their progress. The present development program of Northern Rhodesia must be carried out in its basic principles by the colonial government, supplemented by private initiative only in those fields where government initiative is undesirable. If the development program, as outlined above, is carried out sincerely it will help the natives to increase their standard of living by creating a new society which through the process of development may achieve in time progress that would be beneficial to the entire native population.

Microfilm copy of complete manuscript of 250 pages, $3.13. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1304.

ECONOMICS, AGRICULTURAL

PROBLEMS AND RESULTS IN THE USE OF FARM ACCOUNT RECORDS TO DERIVE COBB-DOUGLAS VALUE PRODUCTIVITY FUNCTIONS

(Publication No. 5917)

Louis Schneider Drake, Ph.D.
Michigan State College, 1952

The purpose of this study is to test the usefulness of the Cobb-Douglas value productivity function for estimating the gross income of a farm by considering the inputs or factors used. This function permits estimating of elasticities of gross income with respect to factors and the marginal value productivities of factors. The hypothesis is set up that experimentation with the function will show that the latter estimates will be useful to farmers. The hypothesis is advanced that differences between recorded gross income estimated from Cobb-Douglas equations can be accounted for by variations between farms in prices received, yields and production rates, choice of enterprises, and size of business. Special attention is given to procedures which will make statistically determined value productivity equations of practical value to farmers.

The data are 194 farm account records for type-of-farming areas 5 and 6, Michigan, 1950. The farms are classified into two groups, dairy and other than dairy. This is done in order that the statistical techniques may be tried on a group of homogeneous farms (dairy), as well as on the more heterogeneous group of all farms. The statistical method consists of converting the farm account data into logarithms and solving for equations estimating gross income by least squares.

Use of the Cobb-Douglas function to estimate gross income and marginal returns to inputs rests on three primary assumptions. These are that the relationship between gross income and any particular input is linear in the logarithms, that gross income is a function of inputs, and that different farms are essentially trials with varying combinations of factors, all farms being on substantially the same value productivity function. These assumptions are considered.

It is shown that the Cobb-Douglas function gives a good estimate of gross income. The estimates of marginal value productivities of factors turn out to be about as should be expected a priori. For different equations estimating gross income the marginal value productivity of investment in land varies between 0.034 and 0.096 in its estimated value. The estimate of the marginal return to investment in machinery, including obsolescence and depreciation as well as interest, ranges from 0.23 to 0.35. These estimates and similar ones refer to the return to a marginal dollar of investment or charge.

The results of the work suggest that farm business analysis reports may profitably include the following information:

1. Estimates of gross income, so that a farmer would have a notion of what he should receive, considering his inputs in relation to the inputs of other farmers.
2. Estimates of average marginal value productivities of factors for all farms so that there should be an additional basis for recommendations for future expenditures on the average farm.
3. Estimates of marginal value productivities on individual farms to help farmers plan for the future.
4. Explanations of differences in gross and net income from their estimated values according to the effects of yields, prices, choice of enterprises, and size of business.

In this study the estimates of gross income and marginal value productivities of inputs are based on all farms, as are the estimates of the effects of differences in yields and prices. The standard of comparison need not necessarily be the "average" farm but may be a group of high-profit farms.

Microfilm copy of complete manuscript of 203 pages, $2.54. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1305.

THE APPLICATION OF MULTIPLE FACTOR ANALYSIS TO THE AGGREGATE DEMAND FOR DAIRY PRODUCTS

(Publication No. 5935)

Harriet S. Siegel, Ph.D.
Michigan State College, 1951

The objectives of this study were:

1. To analyze economic data concerning economic conditions in general, and dairy products in particular, by means of multiple factor analysis in order to investigate what factors were operative during the two time periods of 1929-1948 and 1929-1941.
2. To determine how well these factors could explain and predict the disappearance of various dairy products, by setting up multiple regression systems based on the factor analyses.

An evaluation of the applicability of the method of multiple factor analysis to economic data was also made.

There were 76 variables included in this study. These were composed of aggregate U. S. data on a monthly basis. These variables were grouped in several different ways. One group combined all variables relating to general economic conditions while other groups covered prices, fluid milk and cream, butter, cheese, condensed, dry and evaporated milk, the production and disappearance of dairy products, and marketing margins. Separate factor analyses

were made of each of these groups for the two time periods.

The factor analysis of general economic conditions showed two distinct factors. These were a general price level factor and an industrial activity factor. The analyses of dairy products showed that the general price level factor explained most of the variations in the wholesale and retail prices of the dairy products. Some of the real wholesale prices were explained by the industrial activity factor, but several real wholesale and real retail prices were found to be independent factors or were indeterminate in structure in these analyses. A milk production factor showed that the production of most dairy products followed the seasonal trend of milk production, although butter production did not follow this trend. Similar factor structures were derived in the factor analyses of the separate time periods, although sharp differences were found in some cases.

Regression systems were set up to investigate how well the factor structures explained the disappearance of individual dairy products. These regression systems were based on the factor structures; the disappearance was the dependent variable in each system, while the independent variables were selected from the factor structures. The coefficients of multiple correlation derived from these systems varied from r = .88 to r = 51. Thus, although in some cases the regression systems based on the factor structures yielded fairly good results, these results were quite poor in other cases. The failure of the regression systems to explain the variations in the disappearance data was probably due to the selection of the variables for the factor analyses, to errors in the basic data, and to the time periods used in these analyses.

There were several serious weaknesses shown by the application of multiple factor analysis to economic data. In many cases indeterminate factor structures were obtained. In some cases conflicting results were obtained from different factor analyses. The use of two different time periods showed that different factors could be obtained from the use of different time periods.

In conclusion, it was felt that factor analysis could prove to be a useful tool in empirical economic analysis for use with unexplored data. Further study is necessary before its value in the estimation of demand relationships can be properly evaluated.

Microfilm copy of complete manuscript of 271 pages, $3.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1306.

ECONOMICS, COMMERCE — BUSINESS

A STUDY OF TUNG OIL PRICE AND ITS DEMAND

(Publication No. 5523)

Robert I. N. Chien, Ph.D.
University of Minnesota, 1953

The purpose of this study is to collect relevent information concerning prices, uses, and trade statistics of tung oil in a single volume and to analyze these data in attempting to determine its past growth trend, cyclical fluctuations, seasonal movements, and spatial relationships among producing areas in China, the exporting port of Shanghai, and the United States. Factors affecting tung oil prices are also studied, their inter-relationships explained, and the relative importance of each evaluated. Since the development of synthetic resins, such as alkyds, the position of tung oil as a raw material in surface coating is then examined, with comments on its possibilities of regaining part of the market which it has lost to various substitutes since 1937.

Based upon a survey of paint manufacturers, the uses of tung oil in paint are tabulated in terms of very broad product groups used by the Bureau of the Census. As may be expected, tung oil has been used principally in varnish and varnish-based products. A finer breakdown of its use pattern than the Bureau of the Census classification is also presented, showing spar varnish as the largest outlet, followed by insulating varnishes, "all purpose" varnish, "four-hour" quick drying floor varnishes, and interior paints and varnishes for cabinet and wall finishes and interior spar.

For the period before 1937, consumption of tung oil grew at a rate faster than varnish production. This is attributed to the increasing use of tung oil in varnish making because of its superior properties and improved technical knowledge in regard to its utilization. Its cyclical movements also followed that of varnish. Its seasonal fluctuations were the greatest in the producing areas in China with the least consistency and were the least in the United States but with the highest stability.

Seasonal price fluctuations, in contrast to the movement of physical quantities discussed in the preceeding paragraph, were highly irregular. Differences in the seasonal pattern between Wanhsien in the Upper Yang-tze River and Shanghai was principally due to changing water levels.

The annual price of tung oil before 1937 followed the wholesale price level in the United States most closely. It moved in opposite direction with tung oil stocks in this country. The effect of tung oil consumption on price was also reflected from a multiple regression equation showing the average relationship among various inter-related factors and price.

In regard to spatial price relationship, for every 10 cents change in the price of tung oil in New York City, tung oil price changed only about 8 cents per pound in the producing center of Wanhsien on the

average. The differential was attributed to changes in business profits.

The position of tung oil in relation to (1) other fast drying oils, (2) all major drying oils, and (3) varnish production, has been declining since 1937. The position of synthetic resins has been increasing rapidly. Statistics for the years 1947 and 1948 for comparison with corresponding data in the 1935-1937 period in general.

In order for tung oil to regain part of the market, a program encouraging low and stable prices is believed to be essential. With regard to the tung oil industry in the United States, further mechanization seems to be the only solution to the problem of high production costs relative to those in China.

Included in the thesis are 32 tables, 25 charts, and a bibliography. The thesis consists of 134 pages.

Microfilm copy of complete manuscript of 140 pages, $1.75. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1307.

LONG-TERM NET LEASING PRACTICE: PROBLEMS OF TAXATION, FINANCE AND ACCOUNTING

(Publication No. 5654)

Albert Harry Cohen, Ph.D.
University of Michigan, 1953

The purpose of this study is to examine recent developments in long-term leasing practice with the objectives of evaluating the method as a financial device and appraising the effectiveness of current accounting procedures in reflecting the results of leasing transactions. Typical lease agreements are examined to determine the relationships which are established.

The institutional market for funds has become the primary source for corporate external financing, and the necessity of tapping this market has materially influenced the development of new financing techniques. A long-term lease with a highly responsible tenant can be made an attractive institutional investment if made "care-free" to the lessor and if a non-cancellable term is stipulated during which the institutional investor would receive rentals sufficient to return the entire investment plus a rate of return consistent with alternative opportunities. In most long-term lease transactions the success of the investment is not dependent upon any residual value in leased property at the termination of the lease.

The fact that a business enterprise financing by long-term lease must vacate the property at the expiration of the lease agreement is a disadvantage of that method compared to debt. There are certain elements in leasing practice which tend to minimize this disadvantage and may, under certain circumstances, overcome it. Leasing enterprises may secure protection through renewal options assuring continued occupancy well beyond the initial term of the lease at a rental considerably below the rentals during the initial lease period.

Probably the most significant element in appraising lease financing compared to debt is the preferential tax treatment allowed lessees. These tax advantages are ones of timing rather than of aggregate monetary amount, but the subjective process of discounting the future weighs current events more heavily than future ones. A procedure is developed whereby the monetary cost of lease financing may be compared with the monetary cost of financing by debt.

In addition to costs measurable in monetary terms any financing method involves the assumption of risks and responsibilities which can be important in appraising the over-all desirability of one method compared to others. It is found that no clear-cut advantage in non-monetary costs can be claimed for leasing.

Current accounting procedures which rely heavily upon the "legal-ownership" concept in presenting the assets of a business enterprise introduce a distortion in both the balance sheet and the income statement of the lessee, and the information currently presented in footnotes to the financial statements is insufficient to convey the real impact of lease financing. A procedure is developed which treats leased properties as constructively owned by the lessee and presents the obligations of the lessee as long-term liabilities. The income accounting required under this procedure is developed and contrasted with procedure currently followed.

The general conclusions drawn from the study are as follows:

1. Long-term lease financing is based primarily upon the credit of the lessee, and hence is restricted to business enterprises of unquestionable financial strength.

2. Lease financing may be a lower cost financing method than alternatives. The cost advantages of lease financing are functions of the tax law, and changes in the law may materially influence the desirability of lease financing.

3. The lessee is speculating on the future course of tax rates and the general price level.

4. The accounting for long-term leases should be such that the user of financial reports is given sufficient data to enable him to perceive the true economic relationships established by leasing. This can be done by presenting leased properties as assets and the obligations assumed as liabilities.

Microfilm copy of complete manuscript of 244 pages, $3.05. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1308.

WHEAT UNDER CONTROL: A STUDY OF INTERNATIONAL WHEAT AGREEMENTS

(Publication No. 5603)

William Thomas Kelley, Ph.D.
University of Pennsylvania, 1951

Supervisor: Grover G. Huebner

The major purpose of this dissertation is to analyse the various intergovernmental wheat agreements

which have been concluded, and to evaluate the respective success or failure of each in accomplishing its objectives. Special emphasis is given to the International Wheat Agreement of 1949, not only as to its structure, but in relation to its repercussions on international commercial policy.

The early chapters of the dissertation present the historical background of the international wheat trade. An especial attempt is made to trace the origins of the world wheat problem which materialized in the third and fourth decades of the Twentieth Century. The specific kinds of disturbances suffered are analysed, and the ways in which nations engaged in the wheat trade attempted to meet the problems engendered on a national level are studied.

Measures of national governmental intervention had the effect of divorcing national wheat prices from world market prices, and afforded protectionistic barriers behind which high-cost domestic producers were kept in business. However, such behavior precluded a necessary reallocation of factors of production and the retirement of marginal wheat land.

Governments interested in wheat turned to international collaboration in an attempt to alleviate the situation. A number of wheat conferences were held from 1927 on. One of these led to the first International Wheat Agreement of 1933. In a chapter devoted to this pioneer effort at agreement in wheat, the essential provisions are analysed, and it is found that the conventional intergovernmental cartel approach was adopted which involved acreage reduction, quantitative export quotas, and similar methods of control. Further analysis is made to explain why the 1933 Agreement was not successful.

A number of efforts to reach understandings in wheat were made after the failure of the 1933 Agreement but none bore fruit until a Memorandum of Agreement was initialled in 1942 by four major exporting nations and one major importing nation. At the same time, a Draft Convention was prepared but never put into effect. These instruments are important because they represent the type of thinking on wheat control which prevailed in the early years of the fifth decade.

The balance of the thesis treats the post-war wheat situation. The changes made in the wheat trade resulting from the dislocations of World War II are traced out. Changes in the basic philosophy of control which gradually occurred with the Hot Springs Conference, the American Trade Proposals, and the international wheat conferences of 1947, 1948 and 1949 are described. Through these conferences a shift in emphasis away from narrow restrictionism and towards a multilateral approach and the protection of the consuming interests is discernible. The culmination of this shift is exemplified by the International Wheat Agreement of 1949.

The 1949 Agreement represents a pioneering effort to extend the principle of multilateralism to commodity agreements. The device of guaranteed markets at mutually predetermined price ranges is substituted for production and export restrictions. Adequate representation for consuming interests is afforded on an international regulatory body, and a new principle of group responsibility is engendered.

The final chapters analyse the theoretical and practical implications of the 1949 Agreement. One chapter places the type of agreement which it exemplifies in a classification of all types of international combinations. Another considers how the 1949 Agreement squares with the proposed International Trade Organization Charter, and another analyses the first year of operation. Finally, conclusions are drawn as to the short run, and long-run implications of international wheat agreements in regard to such questions as stabilization of markets, pricing problems, effect on channels of trade, effect on the trade policy of such countries as the United States, and probabilities of success.

Microfilm copy of complete manuscript of 353 pages, $4.41. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1309.

HISTORICAL AND COMPETITIVE ASPECTS OF GROCERY WHOLESALING IN SEATTLE, WASHINGTON

(Publication No. 5910)

Richard Ralph Still, D.C.S.
University of Washington, 1953

Grocery wholesaling in Seattle is just over one hundred years old, the earliest transaction having been completed by a trading schooner in 1851. The trading schooners were soon supplanted by the semi-jobbing general stores which carried on the small volume of trade for many years. However, Portland and San Francisco recieved a large share of the business until 1883 when the arrival of the railroad helped Seattle's firms overcome their disadvantage of a remote location.

The first exclusively wholesale concern — a general-line grocery wholesaler — appeared in 1887, but it was not until after the Great Fire of 1889 that functional specialization became common. General merchandise wholesalers were influential for a short time; but general-line wholesalers were dominating grocery marketing by 1893, and their position was greatly strengthened by the increase in aggregate demand which accompanied the gold rush to the Klondike in 1897. By the turn of the century Seattle was an important distribution center, Alaska and most of western and central Washington were within her trading area, and general-line grocery wholesalers were among the most thriving enterprises.

Since 1900 competition in the Seattle wholesale grocery trade has become more intense with the expansion of manufacturers' direct selling on the one hand and of the corporate chain and retailer-owned cooperative on the other. These developments, all involving circumvention of the general-line wholesaler, are still growing in importance.

Seattle wholesale grocers have used a variety of techniques in their efforts to adjust to the competitive situation. Apparently concerted action as a protective device was not used until the 1930's, but

the wholesale grocers' trade association was dissolved in 1941 as a result of an anti-trust prosecution. Individual firms have tried: (1) promotion of private brands, (2) operation of limited-function departments, (3) sponsorship of voluntary chains, (4) elimination of unprofitable accounts, (5) conversion to specialty-line wholesaling or to manufacturing, (6) establishment of branches in less competitive areas, and (7) modernization of warehouses. Each method has varied in efficacy depending upon: (1) the competitive position of the firm using it, (2) the time of application, and (3) the skill of the management.

The changing competitive situation is recorded in the number of concerns entering and leaving the trade. Generally entrance rates have fluctuated directly and mortality rates inversely with the attractiveness of the field. Nearly 41 per cent of the firms have lived for one year or less, and only 16.5 per cent have survived beyond ten years. Their average length of life has been only 5.87 years.

There have been two main trends throughout most of the history of Seattle grocery wholesaling: (1) competition has continuously grown in intensity, and (2) individual firms have adopted an increasing amount of specialization in functions performed, merchandise carried, and classes of customers solicited.

To predict the future of the Seattle general-line grocery wholesalers is both difficult and hazardous, but it is likely that the two trends will continue. Increasing competition will probably be generated as the integrated grocery marketing institutions attempt to consolidate their previous gains, and it is possible to apply further specialization to the merchandise handled and to the customer list. It is certain that as long as there are small independent retail grocers, there will be a need for conventional wholesalers. Moreover, the institutional market will probably still be supplied by the grocery wholesalers. Finally, Alaska will provide volume for the local houses, as long as it remains dependent upon Seattle as a source of supply. With these three conditions present, Seattle general-line wholesalers will undoubtedly continue to occupy an important position in the trade channels through which groceries flow on their way from producers to consumers.

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CHINA'S FOREIGN EXCHANGE POSITION AND EXPORT TRADE TO THE UNITED STATES, 1937—1948

(Publication No. 5911)

William Wei-Lin Tsai, D.C.S.
University of Washington, 1953

The subject of this thesis is the problem of foreign exchange in China, from 1937 to 1948, with special emphasis on the postwar years. The study aims to provide a history and analysis of the problem, and of steps taken to meet the shortage of foreign exchange, especially of dollars.

As far back as 1784, Chinese raw materials, mostly tea and silk, were imported into the United States. Before 1937, China usually exported more merchandise to the United States than it imported from this country. During the 1920's, an average value of about US$240 million worth of Chinese commodities (at 1948 wholesale prices) was imported into the United States annually. The Great Depression, and the rise in the price of silver, caused a drop in United States imports from China from 1930 to 1936. However, in 1937 such imports partially recovered and were valued at about US$180 million (at 1948 wholesale prices). United States exports to China in 1937 were valued at US$100 million (at 1948 wholesale prices). Thus there was no dollar exchange shortage at that time.

From 1938 until the attack on Pearl Harbor, there was a decline in the foreign trade of China. After the outbreak of the Pacific War in December 1941, there was practically no normal trade relationship between China and Western countries.

When China was reopened for trade in 1946, there was an unprecedented demand for imports. The United States was almost the only commercial nation capable of exporting on a large scale. The defeat of Germany and Japan made it necessary for China to obtain from the United States imports formerly supplied by these two countries (which, with Britain and the United States, had been China's leading suppliers).

This shift in the direction of trade created an acute dollar shortage in China during the postwar period, 1946-1948. Average annual United States exports to China during this period were about 3.5 times the prewar (1937) level. Part of such exports was financed by grants through such programs as UNRRA and ECA. Meanwhile, average annual United States imports from China were about one-third less than the prewar (1937) level. Therefore, a large deficit resulted from this "unfavorable" balance of trade with the United States. This was covered by a heavy drain on the official Chinese Government holdings of dollar exchange and gold.

The main causes of this problem of foreign exchange shortage were two: (1) China's exports revived only slightly, because of the disruption of production and transportation facilities, and (2) trade and exchange control policies tended to encourage imports and discourage exports, especially since the official rate of exchange was kept unchanged for long periods while internal prices were sharply rising. Remittances from Chinese emigrants, which constituted a major credit item in China's prewar balance of payments, declined, making the shortage of foreign exchange more acute.

A more realistic rate of exchange, adjusted as prices rose, might have increased China's exports to the United States; and although it is recognized that such adjustments could not have resulted in a "favorable" balance of trade, the excess of imports might have been reduced. In the longer run, changes in methods of production and marketing might also have

aided in restoring China's exports to prewar levels. Such changes are long-run factors, which could hardly have met the problem during this period. However, the confidence inspired by a vigorous program of self-help might have increased the aid extended by the United States, and thus immediately have relieved the acute foreign exchange problem.

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ECONOMICS, FINANCE

DEPRECIATION FOR TAX PURPOSES

(Publication No. 5670)

Lenore Frane, Ph.D.
University of Michigan, 1953

The purpose of this study is to consider the equity, economic effects, and historical development in the United States of tax allowances for depreciation and depletion, including ordinary cost depreciation, accelerated depreciation, "replacement cost" depreciation, percentage depletion of minerals, "accelerated depletion" of timber, and charges and allowances upon retirement or sale of depreciable and depletable assets. The findings of the study are used as a basis for proposals for tax legislation.

In Part I of the study an "accrued gains" concept of income is adopted as the most equitable basis for income taxation. A "pure" depreciation allowance which is consistent with this taxable income concept and which covers both depreciable and depletable assets is defined; it is equal to "accrued declines in value" during the income period. Existing and proposed depreciation and depletion allowances are compared with "pure" depreciation and shown to differ from it, though ordinary depreciation allowances based on cost are less dissimilar than special allowances such as "replacement cost" depreciation and percentage depletion. Finally, the difficulty of administering a tax system under which "accrued gains" are taxed is recognized, and the question of what is the most equitable "statutory" system is considered. Again, ordinary cost depreciation is defended as the most equitable allowance. The analysis of Part I is carried out first under the assumption that the general price level is stable and then under the assumption that the general price level changes.

Part II of the study consists of a theoretical analysis of probable economic effects of the various depreciation and depletion allowances based on conventional assumptions as to investment behavior. Effects on profit anticipations, liquidity, replacement of depreciable assets, conservation of natural resources, cyclical fluctuations of business activity, and industry structure are considered. Conclusions are tentative, since in many cases there are alternative reasonable assumptions as to investment behavior which lead to opposite economic effects. However, it seems quite likely that the economic effects of "replacement cost" depreciation and percentage depletion are undesirable.

In Part III the historical development of depreciation and depletion allowances in the United States is traced, beginning with the first income tax act introduced during the Civil War. General adherence to an "amortization of cost" concept of depreciation is contrasted with the gradual expansion of percentage depletion for mineral industries. Accelerated depreciation is shown to be a wartime measure utilized to encourage defense production.

Legislative proposals resulting from the study include the following: (1) The proposal that percentage depletion be replaced by depletion based on cost, since it is inequitable and has undesirable economic effects; (2) the proposal that accelerated depreciation be investigated to determine whether it is the most desirable means for encouraging defense production in essential industries; (3) the proposal that "replacement cost" depreciation, advocated recently at Congressional hearings, be rejected as inequitable and undesirable from an economic effects standpoint.

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BRITISH BALANCE OF PAYMENTS POLICY, 1946 TO 1950

(Publication No. 5795)

Franz Gehrels, Ph.D.
Stanford University, 1953

The British balance-of-payments problem from 1946 to 1950 had at least two parts. The first was to limit overall foreign expenditures to the level of foreign earnings; and the second was to acquire enough dollars from direct and third-area earnings to match dollar expenditures. The first part of the problem was made difficult by the unfavorable terms of trade compared with prewar; by temporarily large government expenditures overseas; and by the increase in foreign indebtedness and loss of foreign assets resulting from the war. In addition, the depletion of the stock of producer and consumer durables, and the desire of the public to raise consumption standards made marginal reductions in domestic availabilities unusually difficult to make. Despite these factors, limiting foreign expenditures to earnings was the less difficult of the two tasks, and was no longer critical after 1947.

The second part of the problem, that of matching dollar receipts with outlays, was accentuated by the failure of third areas, notably the overseas sterling countries, to fulfill their traditional roles as suppliers of dollars to London. These areas were permitted to live beyond their means by private capital flows from London, and by use of accumulated sterling balances. They were not compelled in the short

run to supply convertible exchange for any bilateral deficit with the United Kingdom; therefore the mere existence of a surplus by the United Kingdom against the sterling area did not assure it the necessary supply of dollars.

For this reason the prescription of some economists to solve the dollar-shortage by halting inflation and correcting exchange rates was inadequate. Evidences of both existed; but their elimination was unlikely to provide sufficient dollar earnings, so long as the overseas sterling area was failing to provide convertible exchange.

In addition to disinflation and exchange-rate correction, it was urgently desirable for the United Kingdom, Europe, and the sterling area to maintain restrictions on trade with the dollar area, while freeing trade to the maximum extent among themselves. First, such a policy would permit individual countries to balance their dollar accounts without an undue worsening in their dollar terms of trade. These countries, by acting together, could influence favorably their terms of trade with the dollar area by imposing the appropriate degree of discriminatory restriction.

Second, in the five post-war years at least, the United Kingdom and European countries would probably have failed to balance their dollar accounts without restriction, no matter how much they worsened their terms of trade. Achieving bilateral dollar balance would have been extremely difficult and obtaining dollars through conversion of other currencies equally so. The only alternative to discrimination was then restriction on trade with all countries, with a resulting great reduction in trade, to the disadvantage of all parties.

Third, the industries of Europe which might benefit from rationalization and consolidation were unlikely to need a considerable period to make up for the handicap due to the ravages of war, but more especially to reorganize on a more efficient Europe-wide basis. In long-run equilibrium, many such industries would be successful competitors with their counterparts in America. In the intermediate period they might not develop successfully, without protection against American competition.

On the basis of these arguments, the general policy of discrimination followed by Britain and Europe may be judged favorably. This policy was embodied in the sterling Transferable Account system, and in the I.E.P.S. and E.P.U. However, none of these schemes carried discrimination and maximization of trade to the full extent desirable.

Disinflation and exchange-rate correction remained necessary concomitant policies, if over-restriction of trade was to be avoided. Britain was not successful in her domestic stabilization policies and did not practice the desirable flexibility of exchange rates. If she had applied these policies more effectively, the difficulties of reaching external balance would have been substantially less.

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THE CAPITAL STRUCTURE IN AMERICAN BANKING

(Publication No. 5474)

George Taylor Harris, Ph.D.
State University of Iowa, 1953

The capital structure in banking differs materially from that of non-financial corporations; most of the resources have been supplied by the bank's depositors. A bank is deeply imbued with the public interest; the maintenance of the solvency of our banks is fundamental to the American way of life.

The capital structure should be adequate to absorb shrinkages in asset values, sufficient to maintain public confidence in the bank's solvency, and large enough to assure availability of credit to the business community.

In recent years there has been a marked decline in the amount of capital relative to deposit liabilities and earning assets of our banks. This trend has resulted in a situation in which, by all historical standards, many banks are seriously undercapitalized.

A reappraisal of the capital situation clearly reveals that the capital-deposit ratio, the traditional yardstick, does not satisfactorily measure capital sufficiency. Recognition that the character or composition of the resources of a bank tends to determine its possibility of shrinkage in asset values, and hence the amount of capital required, has resulted in the supervisory employment of various "risk asset" ratios. Weaknesses have become obvious, however, in the typical "risk asset" ratio as a measure of capital adequacy. A better method of measurement of capital need is necessary.

The Federal Deposit Insurance Corporation, which provides limited protection against loss to depositors and thus tends to supplement the capital cushion, does not eliminate the need for adequate capital structures.

In presenting a positive program for the improvement of the capital structure of the banking system, a formula is brought forward for more precise measurement of minimum requirements for the individual bank. This formula is based on the principle that the adequacy of capital depends on the relative likelihood of shrinkage in asset values. Bank resources divided into six basic categories, with each assigned an appropriate percentage of capital need, is a move toward more accurately indicating a sufficient minimum of total capital protection.

Having calculated the minimum capital requirement of even the best managed and most conservative banks, supervisors must consider many intangible items, such as skill of management business prospects for the community, et cetera, to determine whether additional capital beyond that called for in the minimum formulation is necessary for any given institution under scrutiny.

Although the aggregate capital position of our banks may at present be sufficient for any periods other than acute crises, not anticipated, many individual banks are undoubtedly decidedly undercapitalized. These can be discovered by application of the supervisory formula developed in this paper, and

steps taken toward alleviation. In implementing this program, legislation giving supervisory agencies power to enforce their directives toward capital expansion is highly desirable. An improvement in the quality of bank assets would ordinarily be preferable to forced-draft additions to capital for inadequately capitalized banks. Bank capital should be private capital, if we are to maintain the private enterprise nature of our banking system.

Any capital ratio is only an objective tool which must be used as a supplement to knowledge and good judgment. The results of the application of the proposed formula ought to be interpreted and evaluated in terms of external factors.

Although capital ratios, on the average and in individual banks, appear to be lower than the optimum, a study of the present situation indicates no immediate cause for alarm. However, in the absence of positive measures for improvement it appears probable that the deterioration of the capital structure in American banking will continue compatably with the trend of the last seventy-five years.

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ECONOMICS, HISTORY

TRADE BETWEEN EGYPT AND THE UNITED STATES

(Publication No. 5540)

Mahmoud K. Issa, Ph.D.
University of Minnesota, 1953

Before the first World War trade between Egypt and the United States was practically one sided. While the United States imported heavy shipments of long-staple cotton from Egypt averaging about $12,000,000 annually from 1908 to 1914, its exports to that country during the same period averaged only $1,500,000. Egypt's needs, for the most part, were furnished by the European countries. There were three reasons behind the failure of the United States to compete successfully with Europe. First, the American manufacturers were not acquainted with the nature and needs of the Egyptian market. Secondly, American banking facilities were entirely lacking in Egypt, a fact which limited the extent of credit to Egyptian buyers. Thirdly, the absence of direct transportation between the two countries was perhaps the most deterrent factor in the trade relationship between the two countries. In 1922, however, the United States succeeded in securing a permanent foothold in the carrying trade of Egypt. Therefore a direct and regular sea line was maintained between the two countries, and American sales in Egypt were increased tremendously.

Owing to the Great Depression the trade between the two countries from 1929 to 1933 was seriously curtailed. Egyptian imports from the United States, however, recovered quickly after 1933, and by 1938 they even surpassed those of the pre-depression years. On the other hand, American cotton imports from Egypt showed a completely different story. In 1930, in order to protect her cotton growers, the United States imposed a 7¢ duty on imports of long-staple cotton. This, added to the bad effect that the depression had had on the textile industries, kept imports of Egyptian cotton at a very low level during the 1930's. In the meantime there were technical changes in the rubber industry, the main user of Egyptian cotton, that permitted the successful use of American short-staple cotton in tire fabrics.

The effort of Americans to grow Pima cotton, in Arizona, a variety similar to that of the long-staple Egyptian, began shortly before World War I, and achieved its highest success by 1921. Thereafter the size of the crop declined rapidly. The labor problem in connection with the picking process proved to be too great to overcome in the sparsely populated region of Arizona. It was found during an investigation carried out by the Tariff Commission in 1948 that the production of Pima cotton was profitable only when its market price was two and a half times that of American Upland cotton. Stimulated by the increased demand for cotton and the difficulty of securing Egyptian cotton along with the high price of it during the war period, the production of Pima cotton was greatly increased. After the war its production declined more rapidly than before, and its production amounts now to only a few thousand bales annually.

The Second World War had the effect of advancing American sales in Egypt. This was largely due to the difficulty of securing goods from the European continent. Thus the United States became Egypt's second largest supplier of manufactured goods. If it had not been for the difficulty of obtaining American dollars, it is probable that the United States might even have become Egypt's first supplier. To overcome her shortage in dollars, Egypt advocated multilateral trade, and secured American goods from other countries that were willing to accept payment in sterling. When Egypt was denied the use of her sterling funds in that manner, she devised the Egyptian Export Pound. This pound was used for the procurement of American goods from countries which accepted it in payment. Thus, in 1950 for example, it was estimated that ninety per cent of the American goods consumed in Egypt were secured through the use of the export pound.

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FOOD AND AGRICULTURE IN JAPAN, 1880—1950

(Publication No. 5799)

Bruce Foster Johnston, Ph.D.
Stanford University, 1953

The key elements in Japan's food economy — domestic production, imports, and population — are traced in broad outline over a period of seven decades. In addition to describing the outstanding characteristics of Japan's agricultural economy, considerable attention is given to improvements in agricultural productivity and the significance of those gains in relation to Japan's economic development in the late 19th and early 20th Century. Special attention is also devoted to Japan's critical food problems during the second World War.

The increase of agricultural productivity in Japan mainly took the form of a substantial increase in crop yields during the decades following the 1880's. Although many factors contributed, expanded use of fertilizers and the introduction of improved varieties were most important. The increase in national product resulting from expansion of agricultural output made an important contribution to the heavy costs of industrialization. In part this was a direct contribution in the form of a disproportionately heavy share of the tax burden paid by the farm population, but the expansion of agricultural output also contributed indirectly through minimizing the inflationary pressure of industrial development and urbanization.

Until the end of the first World War, the increase in home production provided most of the additional food supplies needed to feed the growing population. During the interwar period, domestic production of the staple crops — rice, wheat, barley, and potatoes — showed little change. Since the population continued to rise, this necessitated increasingly heavy reliance on food imports. During the 70 years following 1872, Japan's population increased nearly two and one-half times, a rate of growth quite similar to the increase of population in countries of Western Europe during comparable periods of industrialization. For example, in the 70 years following 1801, the population of Great Britain increased by nearly two and one-half times, from 10.5 to 26 million. In Japan the increase was from 33 million in 1872 to 75 million seven decades later. Thus Japan's population was already quite large relative to her limited land area at the beginning of the period of rapid growth.

Owing to heavy dependence upon imports, Japan experienced a critical food problem during World War II. Shortages of fertilizer, labor, and farm implements all affected agricultural output adversely, but the level of production of the staple crops was fairly well maintained. The fish catch, highly significant as a source of protein, declined sharply as did the production of livestock products. Ultimate failure of the government food program, however, resulted from inability to maintain the flow of food from foreign and colonial sources because of enormous losses of shipping and steady tightening of the Allied blockade. These had brought the importation of food to a virtual standstill by the time of surrender.

A final Chapter is devoted to the postwar period and the severe food shortage experienced during the first two or three years of Allied occupation. During those years the level of imports was restricted by a world-wide grain shortage which made it impossible for food-deficit countries to satisfy their import needs in full. Briefer consideration is given to postwar programs for enlarging Japan's agricultural production, and their relation to the objective of insuring an adequate food supply for a population which is still increasing at a rapid rate. Abnormal factors related to the war were largely responsible for the very sharp increase in population from 75 to 83 million between 1945 and 1950. But a marked decline in the death rate as a result of improvements in the public health program was an important factor which seems likely to be permanent.

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ECONOMICS, THEORY

A MACROECONOMIC APPROACH TO DISTRIBUTION THEORY

(Publication No. 5455)

James William Beck, Ph.D.
State University of Iowa, 1953

The "principles" according to which the total national product is shared among the cooperating agents of production have received a major share of the attention of theoretical economists from the time of Ricardo to the present. The distributional problem has retained its significance not only because it must necessarily be faced in any general theoretical work, but also because it is a matter about which public policy must be formulated, even if the "policy" be laissez-faire.

Broadly speaking, modern theories of distribution fall into two categories: (1) those based on hypothetical or empirically derived production functions, and (2) those formulated in terms of aggregates of income, investment, the level of employment, consumption, and fiscal operations. In general, the former type of theory is based on concepts applicable to the firm, and generalized to the economy as a whole. The contributions of Philip Wicksteed and Paul Douglas, representative of the first category, are analyzed, critically in Chapter II. Macroeconomic theories of distribution as stated by Thomas Schelling and Kenneth Boulding are also presented and contrasted in Chapter II.

The work of John T. Dunlop, covering the years of the Great Depression is reviewed and carried forward through the war period in Chapters IV and V. Dunlop's approach to the study of the determinants of labor's share of national income is sub-aggregative,

being based on statistics for a number of industry groups. Briefly, Dunlop found that, in the depression, the rise in labor's share of total income resulted from increased shares in several of the important industry groups, and only secondarily from a shift in the direction of increased relative importance for industries in which labor received higher than average shares of income. In contrast, during the period of war-time expansion, the increase in the aggregate share of income received by labor is attributable primarily to the increased relative importance of industries paying out to labor above-average shares of income produced. In particular, the marked increase in the role of government contributed very significantly to the larger share received by labor during the war years.

In Chapter VI, fluctuations in labor's share are related to the changes in the degree of utilization of "normal capacity" in the economy. It is demonstrated that, since 1929, labor's share has increased as the degree of utilization of capacity either increased or decreased significantly from "normal." The relationship between the increase in labor's share and the decrease in the degree of utilization of capacity appears to hold at the industry level as well as at the economy level. That is, labor's share within most industries appears to rise as the rate of output decreases, and, in the short run, as the degree of utilization of capacity declines. However, the increase in labor's share associated with a rate of utilization in excess of "normal" does not seem to be reflected in the behavior of the individual industries. Rather, a major portion of the increase in labor's share in years of "abnormally" high output rates resulted from increasing importance of those industries in which the share of labor was higher than the national average. Nevertheless, this change in the relative importance of industrial groups may also be the result of operation of the economy at beyond "normal capacity" rates of output. However, in a number of industries there was an increase in labor's share along with the increase in real output and, presumably, degree of utilization of capacity. This increase in labor's share does not appear to be attributable to operation in excess of "normal capacity," but rather to peculiar war-time phenomena.

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SOME CONCEPTUAL ASPECTS OF THE COMPARATIVE MEASUREMENT OF ECONOMIC GROWTH

(Publication No. 5583)

Richard Ainley Easterlin, Ph.D.
University of Pennsylvania, 1953

Supervisor: Simon Kuznets

The purpose of this study is the selection and quantitative formulation of the concept of economic growth for use in historical comparisons and appraisal of one possible mode of generalization on the basis of such comparisons.

What is economic growth? In the opening chapter an answer is sought to this question in terms of the principal purpose at hand, viz., derivation of a unitary measure of growth by means of which relative levels and rates of growth in different times and places might be established. Attention is also given to selection of a measure for appraising the results of policies directed toward economic growth, the latter viewed as a social objective. The following questions are considered: Can an objective measure of economic growth be secured or must recourse be had to measures requiring social value judgments? Under what conditions will a "symptomatic" index provide an acceptable substitute for a comprehensive measure of growth? If a comprehensive measure is used, what end purpose of economic activity should be assumed — consumers' welfare, national power, or capital accumulation? Is a measure of stocks (wealth) or a measure of flows (income) preferable? Should the measure be expressed on an aggregate, per capita, or per man-hour basis? Would a measure of income distribution reflecting the level of mass poverty be more appropriate than any of these? After weighing arguments pro and con on these questions, total product is tentatively selected for historical analysis and product per capita for appraisal of policy. In both cases "product" is defined with reference to consumers' welfare as the aim of economic activity.

In the following chapter attention is turned from examination of the nature of economic growth to a closely related question: What is the unit that experiences economic growth? Principal consideration is given to the political state. The possibility of justifying selection of the state in terms of certain formal criteria is considered first, after which attention is turned to several theoretical arguments favoring such choice. Finally, an attempt is made to resolve some of the complications that may arise in using the state, complications due to manifest contradictions between the political and the economic unit and to changes in the political unit over time.

Given the state as the unit of growth and the product aggregate framed with reference to consumers' welfare as the measure of growth, national income becomes the concept most appropriate for historical comparisons of levels and rates of growth. Since none of the current offical "income" aggregates is aimed at measuring welfare, however, the next chapter considers the possibility of bridging the gap between the concept selected and those commonly in use. Taking the United Nations concept as representative, an attempt is made first to establish the specific ways in which this measure falls short of a measure of welfare. Various modifications suggested in the literature are then reviewed and appraised, in the light of which suggestions are offered on some rough adjustments that might provide closer approximation to the welfare concept. Finally, the indexes of production to approximate real national income are examined

In the concluding chapter attention is turned to estimates of capital requirements for economic growth by the United Nations and Colin Clark, the mode of generalization followed in these estimates being considered representative of much recent quantitative work in this field. An attempt is made first to establish the theory of growth implicit in these estimates and then, on this basis, to evaluate the solution they suggest to the problem of historical generalization.

Microfilm copy of complete manuscript of 288 pages, $3.60. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1318.

THE INCOME ELASTICITY OF FOOD PURCHASES, 1929—1948

(Publication No. 5598)

Morris Hamburg, Ph.D.
University of Pennsylvania, 1952

Supervisor: Simon Kuznets

Most of the empirical studies of the relationship between expenditures and income have been either time series or cross section analyses. This study presents a series of cross section analyses at different points of time. The association between the volume of consumer food purchases and income in 1929, 1933, 1939, and 1948 is primarily examined. The study differs from the usual cross section analysis in that the state was used as the unit of association between expenditures and income. The basic data were the census figures on value of sales of food stores and the Department of Commerce series on income payments to individuals by states for the years studied. Both food sales and income were expressed in per capita form to prevent state population from obscuring the significance of the observed correlation. In addition, various refinements were made in the definition of food purchases and income.

The interest of this study is primarily in the income elasticity of purchases in various food categories. The actual statistical investigation involved the fitting of least squares straight line regressions of the form Log Y = A + b Log X, where Y is the dependent variable, food purchases, and X is the independent variable, income, to the data for the lower and upper halves of the forty-eight states by per capita income and for all forty-eight states combined. In the above equation b, (the regression coefficient), or the slope of the line, is directly a measure of the income elasticity of purchases in the specified food category.

Two different types of income elasticities were computed in this study from census food purchases data. They are referred to as "type of store elasticity" and "product elasticity." The census sales of food stores data by states were used to compute the type of store elasticities. The sales of specific food commodities, on the other hand, as computed from the census data, were used to derive the product elasticities. The type of store income elasticities computed in this study were based on total sales of food stores and five subclassifications, which were relatively homogeneous groupings of census categories, namely, (1) grocery and combination store sales, (2) meat and fish market sales, (3) dairy product store, milk, egg, and poultry dealer sales, (4) fruit store, vegetable market, delicatessen store, bakery and caterer sales, and (5) candy, nut, and confectionery store sales. Product elasticity figures were computed from the 1939 census data for three commodity groups, sales of (1) groceries, (2) meat and fish, and (3) candy, nuts, and confectionery. The various classifications were taken to be illustrative of consumer purchases of necessities and nonnecessities in the food field and of purchases which fell in between these two extremes.

Comparisons of the results of the product and type of store elasticity computations carry some very interesting marketing implications. For example, the data suggest that, over the period covered, the meat market has become a more specialized type of store, handling better grades and more expensive cuts of meat.

There was a great deal of variability in the temporal movements of the income elasticity coefficients. However, a certain portion of the findings tended to persist in time and space.

1. The income elasticities of purchases of food nonnecessity items tended to exceed the income elasticities of purchases of food necessity items.
2. The purchases of both food necessities and food nonnecessities tended to be less elastic in the higher income ranges than in the lower.
3. There was a tendency toward a lesser decline in income elasticity of purchases of food nonnecessities than in purchases of food necessity items.

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ECONOMIC VALUES IN NONLITERATE CULTURES: A CROSS-CULTURAL REORIENTATION TO THE THEORY OF VALUE

(Publication No. 5844)

Edward Emile LeClair, Jr., Ph.D.
Clark University, 1953

This dissertation, using the method of test analysis, seeks to establish the practicability of making analyses of the economies of nonliterate cultures in such a way that they will be directly comparable with the materials of modern economics.

The introduction chapters briefly examine certain anthropological and economic concepts to indicate their relevance and importance for the current inquiry. In addition, there is undertaken a critical examination of the major treatments of nonliterate economies by certain anthropologists, principally

those of Bronislaw Malinowski and Melville Herskovits.

Three cultures, the basic productive activity of all of which is agricultural, are analyzed. Brief descriptions of these cultures and of the results of the analyses follow.

Panajachel is a village in Guatemala. About three-fourths of its total population are Indians, with whom the original field study was concerned. The economy is a specialized, agricultural, pecuniary, market economy. In addition, the market appears to be singularly free of "imperfections" in that non-monetary considerations rarely influence market decisions. The result is that the economy of Panajachel appears to be as nearly perfectly competitive, in the technical sense, as it could practically be.

Dahomey is a French colony on the west coast of Africa. Much of its production is for the market and there are many specialists in various productive activities. Nevertheless, religion, rather than the market, is the dominant element in Dahomean life. The market is subject to a high degree of regulation — by the king before the conquest by the French, and now by guilds which are not unlike the craft guilds of medieval times. In addition, there is a strong tradition of cooperation, a number of different organizations providing either pools of labor or serving essentially as insurance organizations. Despite these aspects of the culture, it is found that the traditional categories of analysis provide a suitable framework for analyzing the phenomenon of value in this culture.

Wogeo is a small island off the coast of New Guinea with approximately 900 inhabitants. Such trade as exists is with other communities rather than within the community. Apart from goods so traded, each household unit is virtually self-sufficient. Transfer of goods within the community involves the exchange of goods for like goods. Despite the limited trade, it is possible to make some rough estimates of economic value and to find the roots of this value in the two basic elements which give rise to such value everywhere: desirability and scarcity.

While these cultures were chosen because of the suitability of the available materials, the materials were not always adequate for our purposes. Nevertheless, the analyses made seem to demonstrate not only a practicability of our initial proposal, but the practicability of making such analyses on an even more ambitious scale than could be attempted here.

The research upon which this dissertation is based was made possible by a grant from the Social Science Research Council. It was carried out at Northwestern University under the supervision of Professor Melville Herskovits.

Microfilm copy of complete manuscript of 305 pages, $3.81. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1320.

THE CAPITAL PRODUCT RATIO AND SIZE OF ESTABLISHMENT FOR MANUFACTURING INDUSTRIES

(Publication No. 5622)

Stanley S. Schor, Ph.D.
University of Pennsylvania, 1952

Supervisor: Simon Kuznets

The ratio of dollar value of capital to dollar value of product, in general, declined with increases in plant size for manufacturing industries in 1904. This over-all tendency probably resulted from the general small size of plants as compared to the optimum size plant.

The ratio behaved differently for individual industries. The most important factor affecting the variations of the capital product ratio within industries appeared to be the stage of growth of that industry. All industries in the throes of rapid expansion exhibited declining ratios with increases in size. Most industries in a stage of growth either before or after rapid expansion evidenced rising capital product ratios.

The level of the industry wide ratio was probably the second most important factor. High ratio industries tended to show a rising capital product ratio with increases in size and vice versa.

Akin to this factor and probably just as important was the degree of vertical integration in the industry. The more operations performed in manufacturing a product in an industry, the greater was the tendency for a rising ratio.

The association between average size of plant in an industry and the behavior of the ratio with increases in size did not appear to be very striking, nor could the differential effect of the cycle be thought of as having a relatively great effect in this year.

In 1947 there was a general tendency toward a rising ratio of fixed capital to sales with increases in firm size. This rise was also apparent in 1931 and 1937. Since all three years vary as far as economic activity is concerned, secular factors present in all of these years probably bring about the rising ratio. The more important of these secular factors are the decline of competition and the increasing maturity of the industries.

From 1931 through 1947 the industry capital product ratio declined for all industries. This decrease, however, was probably brought about by price movements coupled with certain cyclical effects on the denominator of the ratio causing more or less unused capacity in various years. It could not be established from the data whether a capital product ratio adjusted for cyclical variations and for lags in the evaluation of the numerator and the denominator accompanied by changing price levels would show an increase or a decrease over time.

There seemed to be a convergence of the industry capital product ratios from 1904 to 1947. There was a much wider range from the lowest to the highest

ratio industry in 1904 than from the lowest to the highest in 1947.

The behavior of the capital product ratio as size of establishment increases reversed itself for most industries from 1904 to 1947. In the early year there was a decided downward tendency with increases in size but in the later year the tendency was even stronger in the upward direction.

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THE MECHANIZATION OF COTTON PRODUCTION: A CASE STUDY IN THE THEORY OF ECONOMIC DEVELOPMENT

(Publication No. 5627)

James Harry Street, Ph.D.
University of Pennsylvania, 1953

Supervisor: Simon Kuznets

A major transformation in methods of cotton growing has occurred within the western portion of the American Cotton Belt during the most recent decade, and it appears that the transition to total mechanization is now technically feasible on at least the larger farms in most parts of the region. Because of the importance of the crop, especially in the southeastern states, the change promises to create profound economic and social effects.

Treating the cotton economy as a case of retarded economic development, this study seeks to answer two questions: (1) In light of the early history of vigorous growth of the cotton enterprise and the history of mechanization of other major crops, why was technological advance in cotton production so long delayed? (2) Why has there recently occurred a marked acceleration in the process of technological change within the enterprise?

The long retardation of technological advance is attributed largely to the inhibiting influence of prevailing institutions, whose long-term development is surveyed. The primary effect of these institutions has been to maintain a redundant labor supply, the existence of which discouraged the introduction of alternative modes of agriculture as well as of labor-saving devices in cotton growing. Other factors adversely affecting the rate of technological innovation were the technical difficulties of perfecting practical mechanical harvesters and means of weed control; and certain unfavorable exogenous influences; competition from foreign and domestic substitutes, population backflow during years of industrial depression, and the unstabilizing market effects of depression and wars. The combined effect of these influences was to discourage entrepreneurial drive severely.

The recent acceleration of the process of total mechanization is explained as primarily the result of a remarkable concurrence of technological achievements: the development of successful mechanical cotton pickers and strippers, complementary methods of weed control, and a number of subsidiary innovations in plant breeding, plant defoliation, and lint processing which tend to facilitate the transition from partial to total mechanization. The study also attaches significance to the finding that total mechanization has been most rapidly introduced in western portions of the Cotton Belt where institutional barriers have been least restrictive.

The influence of World War II on the rate of innovation is examined, and the thesis that the war created a "labor vacuum" compelling the substitution of machines is questioned, except for very limited labor shortage areas. More importance is assigned to the fact that the war generated high rates of domestic demand for cotton and that farm incomes consequently rose sufficiently during and after the war to permit the rapid introduction of partial mechanization into the less advanced portions of the region. Several types of tenure arrangements designed to facilitate the ultimate transition from partial to total mechanization on the larger units are described.

The study concludes with a brief consideration of some of the economic and social implications of the changes under way. The significance for price policy of the widening disparity in production methods which may be expected is discussed. Because total mechanization is highly labor-saving, a continued displacement of farm population is predicted, along with an increase in rural living standards and the partial alleviation of long-standing racial and child labor problems.

Microfilm copy of complete manuscript of 392 pages, $4.90. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1322.

THE MEASUREMENT OF INDUSTRY LOCATIONAL PATTERNS

(Publication No. 5748)

Wilbur Richard Thompson, Ph.D.
University of Michigan, 1953

The purpose of this study is to formulate a methodology designed to measure numerically and aid in the theoretical rationalization of industry locational patterns. The technique is to superimpose a "grid" upon a land area, thereby, subdividing the land area into a number of discrete "spatial reference units." Two statistical techniques were applied, compared and evaluated. The author's "Coefficient of Spatial Variation," in which the standard deviation of an industry's employment expressed as a percent of total employment for the various spatial reference units is divided by the arithmetic mean of these percentums, is compared with Edgar M. Hoover's "Coefficient of Localization."

These numerical indices may be misleading if only one degree of areal subdivision is employed. When the land area is highly subdivided industries

with a relatively large number of firms exhibit low values of the two coefficients, regardless of their overall patterns of spatial distribution. However, if the spatial reference units are areally enlarged and the coefficients recomputed, only those industries which are spatially dispersed exhibit rapid diminution in the values of the coefficients due to the "averaging out" of "spatial discreteness" of location. Therefore, the coefficients range from measures of firm "density" to measures of industry "scatter" as the degree of areal subdivision lessens. The Coefficient of Spatial Variation is judged to be superior to the Coefficient of Localization in that the former weights all spatially reference units equally, whereas the latter weights the various spatial reference units in proportion to their total employment, thereby, biasing the index in favor of the displacement of the more populous units from the group.

The Coefficients of Spatial Variation of forty-four Census industrial classifications are computed at five levels of areal subdivision: forty-one Michigan counties, four Michigan regions, forty-eight states, nine national divisions and three national regions. Primary and secondary industries, with the exception of "construction," exhibit relatively high coefficients at all five levels of areal subdivision. "Construction" and most tertiary industries exhibit relatively low coefficients at all five levels of areal subdivision, with the major exceptions occurring at the county level only.

If the spatial reference units are successively enlarged until no further significant dimunition of the coefficient can be achieved, approximate conjunction of the spatial reference unit and the maximum firm product market area (or factor market area, whichever exercises the dominant locational attraction) characteristic of the industry can be reasonably inferred. Thus, having eliminated spatial discreteness of firm location stemming primarily from economies of scale as modified by transportation costs, investigation of additional locational determinants may be pursued at the corresponding level of areal subdivision. Proceeding at the national divisional and state levels of areal subdivision for "wholesale trade" and "automobile storage, rental, and repair service," respectively, the two industries are correlated with income per capita and density of population. Assuming a linear relationship, both independent variables exhibit significant (at the .05 level) regression coefficients.

Microfilm copy of complete manuscript of 139 pages, $1.74. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1323.

EDUCATION, GENERAL

A COMPARATIVE STUDY OF TEACHER AND PUPIL RATINGS OF PERSONALITY TRAITS OF BOYS AND GIRLS OF STARK COUNTY AS COMPARED WITH RESULTS OF OBJECTIVE TESTS

(Publication No. 5394)

Gene Franklin Ackerman, Ed.D.
Bradley University, 1952

The purpose of this study is to find ways and means for helping children to make adjustments in their personalities which will better fit them for life in a highly competitive world and to assist classroom teachers in guiding and directing children in personality growth and development.

Data has been collected regarding 398 pupils of twenty class groups of the fourth, fifth, sixth, seventh, and eighth grades in the elementary schools of Stark County, Illinois. Five instruments were used to gather the data: the California Test of Personality, the Otis Quick-Scoring Intelligence Test, the Iowa Reading Test, a personality evaluation of pupils in her classroom by each teacher, and a similar evaluation of the pupils by their classmates. Seven specific personality traits were used for the latter two instruments, which were friendliness, dependability, aggressiveness, leadership, co-operativeness, cheerfulness, and vitality. These were defined and reasons for their choice substantiated by authorities. A description of the primary findings was given, with emphasis placed on the pupil ranked highest and the pupil ranked lowest in each of the twenty groups. These children were compared on the five results. Group comparisons were made by finding out the amount of relationship which existed between the teacher rating and the pupil ratings and the three objective type instruments.

Based on the data examined in this study concerning pupils in grades four through eight in schools of Stark County, Illinois, it appears that:

1. There is a high degree of uniformity among children in their rating of a fellow student, irrespective of their own rank within the class group.
2. Children who are shown by the objective tests to be of low mental ability and/or low reading ability tend to be rated low by their peers and teachers.
3. Children who are shown by the objective tests to be of high mental ability and/or high reading ability tend to be rated high by their classmates and teachers.
4. Children with low mental ability apparently have difficulty in achieving well-adjusted personalities, since the results of the tests show that 45 per cent of those children rated in the lowest quartile on the California Test of Personality are in the lowest quartile on the Otis Intelligence Test.

5. A child with a lack of personality adjustment may be inclined to have difficulty in the pursuit of academic subjects such as reading since the results recorded show that 40 per cent of the pupils who rated in the lowest quartile on the California Test of Personality also rated in the lowest quartile on the Iowa Reading Test.

6. Children with high mental ability apparently tend to have well-adjusted personalities since the results of the tests show that of those children rated highest on the California Test of Personality 50 per cent are in the highest quartile on the Otis Intelligence Test.

7. A child with a high degree of personality adjustment seems to succeed in such a subject as reading, since the results of the tests reviewed in this study show that 65 per cent of those ranked highest on the California Test of Personality were in the highest quartile on the Iowa Reading Test.

8. Teachers can generally place the pupils highest and lowest in personality traits according to their judgment for their specific group, as only five of the twenty teachers considered more than one pupil highest in rank in the class, and only two of the twenty teachers considered more than one child lowest in rank for the class group.

9. Low mental ability and/or poor reading ability may have caused some of the pupils with good personalities to rank very low on the California Test of Personality, which is a reading type of test.

10. Teachers tend to evaluate a child's personality more from mental ability and achievement than from pure personality traits.

11. Boys and girls also tend to evaluate their peers on personality traits according to mental ability and achievement which might be a result of their teacher's influence.

12. Apparently the teachers should study the children in their classes and help them to make better adjustment to school, since 58 per cent of the 398 cases studied indicated lack of adjustment in school relations.

Microfilm copy of complete manuscript of 321 pages, $4.01. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1324.

A STUDY OF THE UNDERGRADUATE EDUCATIONAL COUNSELING SERVICES IN THE SCHOOL OF EDUCATION, FLORIDA STATE UNIVERSITY

(Publication No. 5831)

Audrey Lorraine Atherton, Ed.D.
Florida State University, 1953

For some time there have been two national movements paralleling each other — teacher education and student personnel. Only in the last year has there been an attempt and the resulting action of consolidating these movements when there was organized a division of the American Personnel and Guidance Association called the Student Personnel Association for Teacher Education. From this national movement toward unification has come a need for attempts at integration on the local levels.

Locally, the Florida State University has undergone a transition from a women's college to a university. Factors such as increase in enrollment, rapidity of growth, change in characteristics and nature of the student population have made a study of the student personnel services in teacher education a necessity, if such services are to be geared to the needs and demands of the students. It is further emphasized that a teacher training division has a special obligation to provide an effective program of student personnel services.

In order to investigate the effectiveness of the undergraduate educational counseling program in the School of Education, three approaches were used: (1) a general review of the literature on the needs and problems of college students, (2) a series of twenty-five interviews with student personnel officials and heads of departments, (3) a daily log of problems which students brought to the Office of Coordinator of Undergraduate Counseling, School of Education. From these three sources, a questionnaire was devised and administered to some 650 undergraduates and graduates of the School of Education. In addition to determining present effectiveness of the counseling services, an effort was made to compile student reactions and suggestions for expansion of and changes in method of providing services.

The present organizational and administrative structure of the School of Education was used for the pattern of tabulation and analysis of data secured. Data were categorized according to departments and teaching areas as well as student classification levels. In such a way could weaknesses and strengths in the various counseling service areas throughout the School of Education be determined.

Investigation of student satisfaction with all areas of educational counseling services indicated a general ineffectiveness of the present status as well as the several aspects of the counseling relationship. Recommendations emphasized the need for improvement in the total program, incorporating such factors as in-service training for faculty members, increase in the number of faculty members, specific time allocated for counseling purposes, and better facilities for counseling. In view of the fact that two of the major weaknesses lay in the area of the counselor's attitude toward and interest in the students, it was suggested that the entire faculty of the School of Education participate in a study of the need for an underlying philosophy of a program of student personnel services in teacher education.

Microfilm copy of complete manuscript of 268 pages, $3.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1325.

DEVELOPING CRITERIA FOR THE SELECTION OF DIRECTING TEACHERS WITH PARTICULAR REFERENCE TO A SECONDARY PROGRAM OF OFF-CAMPUS INTERNSHIP AT FLORIDA STATE UNIVERSITY

(Publication No. 5830)

Edgar Beaty, Ed.D.
Florida State University, 1953

The Problem

Little research relative to qualifications of directing (supervising) teachers has been undertaken. A few writers have stated criteria for the selection of directing teachers, but their statements have been general and ill-defined. As a basis for the development of criteria for the selection of directing teachers this study was designed to answer two questions: (1) What kind of supervisory relationship (categorized as cooperative, directive, and laissez-faire) between directing teacher and intern (student teacher) provides the best learning experience as indicated by oral and written expressions of emotional satisfaction on the part of interns and directing teachers? and (2) What personal-professional qualities are possessed by directing teachers in the categorized supervisory situations? The relationship between the length and variety of educational experience and the educational background of the directing teacher with success as measured by the criterion was also explored.

Procedures

Two groups were studied: (1) an interview group of thirty-eight directing teachers and their interns, and (2) a written group of sixty-one interns. In the first group the participants were asked to describe the supervisory relationship in a number of situations. Interns described the qualities in their directing teachers which were "liked best" and "disliked most." The directing teachers described the qualities essential for success (and the hindrances to success) in their positions. The satisfaction of both interns and directing teachers was rated through the utilization of five point rating scales constructed by the writer. In the written group interns completed the following: (1) a check list (constructed by the writer) designed to make possible the categorization of supervisory relationship, (2) paragraphs relative to qualities "liked best" and "disliked most" in their supervisors, and (3) a graphic rating scale. In both groups directing teachers completed a questionnaire which pertained to their educational and professional background.

Findings

It was found that interns' satisfaction and category of supervisory relationship experienced were significantly related. Satisfaction of directing teacher and category of supervisory relationship were not significantly related. In both interview and written groups the cooperative supervisory relationships were more satisfying to interns (but not directing teachers) than were either the directive or laissez-faire relationships. There was little relationship between the satisfaction of interns and that of their directing teachers except that the benevolent autocracies were mutually satisfying and the aggressive autocracies mutually dissatisfying. The cooperative relationship provided a better learning experience for interns and stimulated the professional growth of the directing teacher to a greater extent than either the directive or laissez-faire relationship.

The following qualities were characteristic of cooperative directing teachers: (1) emotional warmth, friendliness and congeniality; (2) a cooperative, helpful attitude; (3) facility in putting other people at ease; (4) willingness to accept fellow workers as co-workers; (5) ability to treat situations factually; (6) understanding of frailties of others; (7) effective utilization of a variety of materials and techniques; and (8) the desire to induct neophytes into the profession. The predictive value of the above qualities for the establishment of a cooperative relationship has not been verified.

Positive correlations between interns' satisfaction and (1) years of experience as a teacher, (2) number of grade levels taught, and (3) number of courses taken in supervision by the directing teacher, were significant. Significant negative correlations between interns' satisfaction and (1) number of interns supervised, (2) years of college beyond the bachelor's degree, and (3) the number of subject fields taught by the directing teacher, were discovered.

Criteria based on the findings are stated, and recommendations are made for directors of internship for the selection of directing teachers.

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SOME CRITERIA FOR THE ESTABLISHMENT OF COMMUNITY COLLEGES, WITH SPECIAL REFERENCE TO MICHIGAN

(Publication No. 5918)

Russell Foster Fink, Ed.D.
Michigan State College, 1952

This study was made in the light of two assumptions: (1) that there will be a further increase in the demand for educational opportunities beyond grade XII in Michigan, and (2) that Michigan may seek to meet this demand by encouraging the establishment of community colleges.

The purpose of the investigation was to identify criteria for the establishment of community colleges.

The sources of data were: (1) the reports of educational surveys completed in California, Florida, Georgia, Idaho, Illinois, Iowa, Maryland, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Oregon, Pennsylvania, South Carolina, Washington, West Virginia and Wisconsin between 1940 and 1950, (2) annual reports to

the finance division of the Michigan Department of Public Instruction, (3) Self-survey reports filed by Michigan high schools with the Superintendent of Public Instruction, (4) United States Census reports, (5) personal correspondence, and (6) the literature of the field.

After a review of the history of the development of junior colleges in Michigan and a survey of the case for the community college was presented by several state studies and by authorities in the field, an analysis was made of the probable demand in Michigan for additional educational facilities beyond grade XII.

Based upon the evidence submitted by the state studies and Michigan educational and demographic data it appeared there would be an increasing demand for post high school educational facilities in the years ahead.

The following criteria were developed as the result of a critical analysis of the state studies. (1) High school enrollment is a basic criterion: 500 in grades IX-XII is a recommended minimum with 800 in grades IX-XII an even more desirable standard. (2) Approval of a representative, independent, non-political state educational agency is desirable. (3) Approval of the local community, ascertained by petition, referendum or preferably an intensive community survey is desirable. (4) Existing educational institutions need to be considered from the point of view of the possibility of these institutions meeting the needs of the community and from the point of view of the effect of the inauguration of community colleges on the established institutions. (5) The common estimate of minimum tax valuation appeared to be of little importance as a criterion in Michigan.

The study emphasized the fact that the specific criteria listed should be considered in the context of the total social situation in a given community or state.

Areas for further study suggested by this investigation include: the organization of education in Michigan, the curriculum of the community college, the supply of the demand for community college teachers, the relationship between parents' income and the college-going pattern of youth, the financing of post-high school education, and techniques for measuring community needs and desires in the field of education.

Microfilm copy of complete manuscript of 196 pages, $2.45. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1327.

AN INQUIRY INTO THE DEVELOPMENT AND PRESENT STATUS OF EDUCATION FOR YOUNG CHILDREN IN FLORIDA

(Publication No. 5392)

Sarah Lou Hammond, Ed.D.
Florida State University, 1953

This dissertation is based on an inquiry into the development and present status of education for young children in Florida. The major purposes of the study were: To trace the development of education of young children in Florida from 1875 to 1952; to note and analyze the effect of certain legislation, social and economic forces, and attitudes toward the education of young children in Florida; to identify some important factors which have furthered or retarded the development of schools for young children in Florida; to analyze the present status of education for young children in Florida in light of the national picture; and to point possible direction for the future development of education for young children in Florida.

The primary sources of data were: Reports of the U. S. Commissioner of Education, U. S. Census Reports, Public documents of the State of Florida, Publications and Reports of Florida State Agencies, pertinent letters and personal interviews. Other sources included books, theses, yearbooks, and periodicals.

The historical development of schools for young children in Florida is treated in four periods: Early Private Kindergartens, 1875-1890; Public County Kindergartens, 1890-1946; Federal Emergency Programs of Education for Young Children, 1930-1946; Kindergartens and The State Minimum Foundation Program, 1946-1952.

After the brief historical analysis, the changing economic and social conditions, as well as attitudes and trends in the state are discussed. The results of a sampling of attitudes of parents, lay citizens, elected officials and professional groups in six Florida Counties toward schools for young children are analyzed. The evidence of this sampling indicates that basically the attitudes of the people are not against kindergartens; the public feels that grades one through twelve are the first obligation of taxpayers; and that while many citizens are aware of existing conditions or needs, they do not see in the kindergarten program possibilities for meeting these needs.

The status of education, private and public, for young children at the national level was used as a background for appraising the scope and adequacy of the pre-school program in Florida. The results of this inquiry reveal that while many private preschools are now operating in Florida, there is no law requiring statewide licensing or supervision of such schools. With the exception of five counties and one city in the state, these schools are supervised by no state or county agency. Many private school operators have requested help in meeting common problems. It was found that public school kindergartens are available only to about 2.0 per cent of the five and six year old children in Florida. The public kindergarten teachers as a group are well trained; the programs are flexible, but the facilities seem to be inadequate in many centers.

Based upon the information gained from the brief historical study, an analysis of the social and economic conditions, the sampling of attitudes of citizens, and the appraisal of the present Florida program for education of young children, recommendations have been made regarding the possible direction for the future development of education for young children in Florida. The recommendations deal with legal

provisions for operating and maintaining public kindergartens with high standards; a suggested program of interpretation of the values of kindergartens to the public; a plan for registration of private pre-school centers; training programs for operators of such schools; and further studies needed in the area of early childhood education.

Microfilm copy of complete manuscript of 214 pages, $2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1328.

STUDENT SURVIVAL FACTORS IN THE STOUT INSTITUTE: A STATISTICAL STUDY OF HIGH SCHOOL RECORDS, ENTRANCE TEST SCORES, COLLEGE COURSE GRADES AND OTHER MEASURES WITH RELATION TO SURVIVAL IN AND GRADUATION BY A COLLEGE OF TEACHER TRAINING TYPE-MALE STUDENTS, INDUSTRIAL ARTS DIVISION, FOUR YEARS, 1947-51

(Publication No. 5355)

John Asa Jarvis, Ph.D.
University of Minnesota, 1953

The study herein reported concerns itself with the regularly-enrolled male students at The Stout Institute and was made in an effort to determine:

1. the relationship that may exist between college entrance tests, high school rank, selected high school subjects offered at college entrance, and honor point ratios in the college freshman technical subjects, and in all college freshman subjects.

2. whether these college entrance tests, high school rank, and certain selected high school subjects will assist in identifying those students who will graduate in four years.

To accomplish the aforementioned aims, entrance test records were recorded for 393 students who entered The Stout Institute in the falls of 1947-48, 1948-49, 1949-50, and 1950-51. The "entrance tests" mentioned earlier were the ACE Psychological Examination, the Cooperative English test and the Myers-Ruch High School Progress test. Similarly recorded for those 393 students was the number of mathematics units and the number of Industrial Arts units offered at college entrance.

The preceding six measures were then used to determine if any of the six would serve to identify the student who would later graduate. It was found that the high school rank achieved by those who graduated from The Stout Institute differed significantly from the high school rank achieved by those who did not graduate from this college. Two-year survival at this college was likewise found to be related to high school rank.

All of the preceding six measures were then used to develop regression equations which would serve to predict first semester college honor point ratios in the technical area, in the academic area, and in total scholarship.

The regression equations developed were tested by using the test records, the number of mathematic units offered at college entrance, the number of Industrial Arts units offered at college entrance, and the high school rank achieved by 56 freshmen who entered the fall of 1951-52.

The regression equation developed for predicting grades in the college technical area proved to be unsatisfactory.

The efficiency of the regression equation developed for the college academic area was tested by using the records of the same 56 students who entered this college in the fall of 1951-52. Academic honor point ratios above 1.05 were predicted for 28 of the 56 students, 21 of whom actually earned this ratio (with seven failing to do so). Honor point ratios of less than 1.05 were predicted for 28 students, and only two exceeded this figure (and they were under 1.45).

The efficiency of the regression equation developed to predict total freshman college honor point ratio was tested by using the entrance records of the same 56 students who entered the fall of 1951-52.

With the aid of this equation, a total college honor point ratio of less than 1.05 was predicted for 15 of these 56 students. Only three of the 15 exceeded this 1.05 ratio, each of whom earned less than 1.25. It was predicted that 41 of the 56 students would earn more than 1.05, 30 of whom did exceed this ratio.

As a result of the aforementioned findings, the following recommendations were made:

1. That an entrance requirement based on high school rank be established for The Stout Institute.

2. That the first semester freshman college total honor point ratio and a similar academic honor point ratio be calculated for all entering men as soon as entrance test scores are available.

Microfilm copy of complete manuscript of 254 pages, $3.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1329.

A COMPARATIVE STUDY OF BASIC COLLEGE GRADES AND EFFORT-INTEREST-ATTITUDE RATINGS FOR LOW ABILITY STUDENTS

(Publication No. 5924)

Leonard Stewart Laws, Ed.D.
Michigan State College, 1953

This study was primarily concerned with the establishing of pass-fail points in the grading of Basic College students on a basis of the effort being made by low-ability students. The general hypothesis proposed by the Basic College Educational Research Committee was that "among a group of students, all low in ability, effort should be a significant factor differentiating those who pass from those who fail."

The low-ability group was composed of 120 freshmen who recieved low scores on the 1949 edition of the American Council on Education Psychological Examination during the Fall Quarter, 1952 orientation

program and who failed to increase their score appreciably on a re-test. Information relative to the students' studying was obtained by means of questionnaires sent to the students themselves, to dormitory assistants living in the same housing units as the students, and to instructors having the students in their classes. Each instructor rated his students twice during the quarter.

The study was restricted to first-quarter subjects being offered by the Basic College during fall term. These were Basic 111, first in a year's sequence in Communication Skills, and Basic 121, first in the Natural Science sequence.

Pooled ratings of the students' effort were obtained and correlations between the pooled ratings and grades received in Basic 111 and Basic 121 were computed. There was such a weak relationship between the grades and pooled effort ratings that it was not possible to establish the desired pass-fail points. Comparisons of the effort ratings made by the various observers suggested that they have little in common and might be too crude for discriminating between passing and failing students. More refined instruments are recommended for future studies.

There seemed to be little relationship between the prediction by the American Council on Education Psychological Examination and the grades the students received. Many capable students were included in the low ability group - students who were not in danger of failing regardless of effort. Better prediction will be necessary if future studies of this type are to succeed.

The Basic College has a general policy that: "Instructors' grades and examination grades should meaningfully supplement, rather than duplicate each other." A second purpose of this study was to investigate whether such meaningful supplementation is being evidenced. This investigation utilized ratings on the students' general attitude and ratings on the students' ability that were made by the Basic 111 and Basic 121 instructors. It further utilized the students' stated interest in the respective courses.

The evidence indicates that there might be meaningful supplementation with regard to factors involved in the students' general attitude. However, in the case of instructors' judgments as to students' ability to meet course requirements there appears to be supplementation but not meaningful supplementation. It is recommended that a more extensive study be undertaken to discover wherein the instructors' grades might more meaningfully supplement final examination grades.

Microfilm copy of complete manuscript of 122 pages, $1.53. Enlargements 6" x 8", 10¢ per page Library of Congress card number MicA53-1330.

A STUDY OF OPINIONS TOWARD OFF-CAMPUS COLLEGE CREDIT COURSES

(Publication No. 5926)

J. D. Marcus, Ed.D.
Michigan State College, 1953

The Problem

This study was primarily concerned with identifying the opinions held by students, teachers, and county superintendents of schools toward the values of off-campus college credit courses; and to some extent determining whether these course experiences are modifying teaching practices.

Method, Technique, and Data

The questionnaire-survey method was employed as the technique most appropriate for the approach to the problem. Questionnaire forms were distributed to the students enrolled in the off-campus college credit courses during the fall semester, 1952-'53, of the four Colleges of Education in Michigan; the instructors in the departments of these Colleges who usually teach off-campus classes; and the 83 County Superintendents of Schools in Michigan. Data were collected relative to their opinions regarding values of these classes, modifications in teaching practices which resulted from them, and suggestions for modifying the off-campus college credit course programs.

Findings and Conclusions

In addition to gathering personal information about the students, results of the survey revealed among the major findings that:

1. Experiences with off-campus college credit courses tend to create more favorable opinions toward these classes.

2. As a result of off-campus classes, students generally indicated that when teaching they use more community resources, more pupil participation in school planning, and more modern teaching techniques. They further indicated that changes resulted in their basis for evaluating pupil progress, their methods of reporting to parents, and the use of new teaching materials.

3. The defects or weaknesses of off-campus classes most frequently mentioned were that the classes are often impractical and not meeting the needs of the students, that instruction is often inadequate, that the students are physically fatigued for the work, and that facilities and reference materials are inadequate.

4. The strong points mentioned in favor of off-campus classes were that students obtain information and skill for new teaching techniques and methods, they are more mature and experienced, there is practical application of the subject matter, and the classes result in better teaching in the classrooms of the students.

5. In comparing college credit course work on-campus and off-campus, opinions were generally in agreement that there were only slight differences, if any, between marks, difficulty of work, and testing.

6. It was the opinion of many of the people involved in the study that most college courses could be offered off-campus as adequately as on-campus, that in some cases course content and approach to content can and should be modified, and that modifications are made when these classes are offered off-campus.

Microfilm copy of complete manuscript of 188 pages, $2.35. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1331.

A STUDY OF SELECTED FACTORS RELATING TO THE DEMAND FOR AND SUPPLY OF TEACHERS IN MICHIGAN, 1941—1960

(Publication No. 5707)

Bruce Kern Nelson, Ph.D.
University of Michigan, 1953

The objectives of this study are to ascertain the relationship of selected factors to the demand for and supply of teachers in Michigan during the period 1941-1950, to predict teacher supply and demand in the fifties, and to make recommendations for future planning of teacher supply in the state of Michigan.

Following a review of related studies and comparison of predictions of previous Michigan investigators with actuality, the following demand factors are considered: (1) total population; (2) school age population; (3) school enrollment; (4) number of teaching positions, teachers employed, and pupil-teacher ratios; (5) number of teacher withdrawals; and (6) the annual change in number of teaching positions. Supply factors dealt with similarly are: (1) composition of Michigan's public school teaching population; (2) new teacher certification; (3) teachers entering from out-of-state; (4) specially certificated teachers; and (5) availability of former teachers.

A major portion of the data is secured by sampling personal information cards submitted in 1950-51 to the state retirement fund board by teachers outside the city of Detroit. Additional data are from files, records, and reports of the United States Bureau of the Census, the office of the State Superintendent of Public Instruction, the Michigan Department of Health, the Michigan teacher training institutions, and the Detroit public schools.

Findings disclose that: (1) Michigan's expanding total population probably will grow to 7,448,652 in 1960; (2) the school age population is rising and may reach 2,222,149 in 1960; (3) public school enrollments will probably number 1,511,063 in 1960-61; (4) the need for teaching positions will increase to 53,984 in 1960-61 requiring employment of 63,701 teachers. Concerning teacher supply, the study reveals that: (1) the present public school teaching population is older, better trained, more experienced, better paid and contains more men and married women than it did previously; (2) teacher training institutions may produce 4,000 new teachers annually; (3) out-of-state sources may contribute 1,300 teachers; (4) the total supply of qualified teachers in 1960-61 may be 37,122; (5) special certificates will increase; and (6) returning former teachers may not be as plentiful.

Conclusions are: (1) the Michigan pattern of investigating and forecasting teacher supply and demand is quite accurate; (2) war factors exerted little immediate effect upon total demand for Michigan teachers; (3) war factors did affect immediately and drastically the annual teacher demand and the annual and total teacher supply; (4) adjustments made to balance teacher supply with demand changed the composition of the teaching population; (5) Michigan presently faces a severe shortage of qualified teachers; (6) adequate information on teacher supply and demand is not available to the people of Michigan.

Recommended for increasing teacher supply are: (1) a state-level study commission; (2) acceptance by the Superintendent of Public Instruction of responsibility for conducting research and administering an action program; (3) a state teacher register; (4) a coordinated, continuous program of teacher recruitment; (5) retention of greater numbers of the present teaching population in active teaching; (6) maintenance of present certification standards; and (7) involvement of the general public in developing solutions.

Microfilm copy of complete manuscript of 461 pages, $5.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1332.

AN ANALYSIS OF FICTIONAL SHORT STORIES FOUND IN CURRENT MAGAZINES READ MOST OFTEN BY INDIANA HIGH SCHOOL STUDENTS WITH REFERENCE TO TREATMENT OF AMERICAN SOCIAL CLASSES

(Publication No. 5882)

Velma Lotus Taylor, Ph.D.
Indiana University, 1953

The Problem

The problem of the study was to analyze fictional short stories in the three magazines frequently publishing fiction and read most often by Indiana high school students to determine whether such fiction may lead to the development of undesirable attitudes toward certain American social classes.

Procedures of the Study

Data pertaining to magazine fiction read regularly by high school students were obtained by questionnaires administered to 9,468 students in grades 10 through 12 in 40 city, town, and rural high schools in Indiana. Chief sources of data concerning the short story analysis were (1) the three magazines — The Saturday Evening Post, Seventeen, and Collier's and (2) published material which provided a background for the study and aided in establishing techniques of procedure. Warner's Index of Status Characteristics was used to determine social class. The short story analysis was based on two schedules: one relating to

the characteristics of the short stories as a whole and the other to the characters themselves.

Findings, Summary, and Conclusions

Settings and types of short stories. The United States was preferred as a locale for 86 per cent of the short stories. Over half of these favored New York, California, Massachusetts, and Texas. The Northeastern States were preferred as a section. The Southern States were least preferred. The contemporary world was preferred for 87 per cent of the stories. Three-fifths of the stories dealt with the purely romantic or with social, political, economic, and religious problems.

Status and activities of characters. The preferred social classes were the upper middle, indeterminate, and lower middle, since characters from these levels appeared most frequently in the stories and also received the preferred roles most often. The majority of the characters were single, about two-fifths were married, and the rest were divorced, widowed, and separated. They remained generally in the same marital status and social class throughout the stories. The majority of those making a change in social class moved upward by means of occupation, marriage, talent, and money. These characters were seeking romance, power and fame, justice, and wealth either for themselves or for someone very near. Nearly all reached their goals. They were portrayed as fictional types rather than as real persons of their own level in the real population. Americans of Anglo-Saxon or Nordic origin were preferred by far to minority group characters.

Of the less preferred classes, the five lower classes were least preferred. They received less than their share of the total fictional population, particularly the preferred roles. Nearly nine-tenths of the minority racial group members and half of the members of all American minority groups appeared in these levels. These characters were shown as living in the lowest rated types of houses and dwelling areas and doing the hardest and least desirable types of work. Although they depended mostly upon wages and some upon profits and salary, many depended upon charity or upon illegal sources of income for a living. There were many "down-and-outs," gamblers, racketeers, and criminals. These characters were presented as fictional types or stereotypes rather than real persons and as being less desirable than those in levels above.

The basic conclusion of the entire study is that fictional short stories may lead to the development of undesirable attitudes toward certain American social classes. Certain social classes were consistently given most preference throughout the stories while other classes were consistently given least preference and were portrayed at a disadvantage in the stories. The lower classes were least preferred and were portrayed at a disadvantage.

Microfilm copy of complete manuscript of 191 pages, $2.39. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1333.

COUNSELOR TRAINING IN STATE SUPPORTED NEGRO COLLEGES AND UNIVERSITIES IN STATES WITH DUAL EDUCATIONAL SYSTEMS

(Publication No. 5937)

Ray Thompson, Ed.D.
Michigan State College, 1953

This study was an effort to gather information relative to the present status of courses for training counselors in the state supported Negro colleges and universities in the states with dual educational systems; to list the courses that offered and proposed for offering which might prove to be suitable for background and professional counselor training courses; to determine the essential kinds of services school administrators feel guidance workers should be competent to offer; to bring together the findings of the study and some of the most accepted generalizations and concepts dealing with counselor preparation; and then synthesize the findings of the study with the generalizations and concepts in order to make suggested recommendations to facilitate the setting up of counselor-training programs in the state supported Negro colleges and universities that were studied.

The writer used personal interviews, examined college catalogues, and mailed out questionnaires to gather the data reported in this study.

A questionnaire was mailed to a select group of public school administrators in the seventeen states having dual educational systems. These administrators had been recommended by their state departments of education as being competent to list the student personnel and guidance needs of boys and girls in their particular states. The recommendations stated, further, that they were capable of giving competent opinions as to whether the state supported Negro colleges and universities were providing the kind of training needed by counselors who would be able to serve the needs of boys and girls.

Information concerning the status of counselor-training in the thirty state supported Negro colleges and universities studed was gathered from each institution. This information was compared with the information collected from the school administrators and with the suggestions for counselor-training in the National Vocational Guidance Association publication on Counselor Preparation.[1]

The following conclusions seem to be tenable:

1. The guidance needs of pupils residing in the states with dual educational systems are basically the same as those pupils residing elsewhere.

2. Public school administrators, state guidance officials, and college officials included in this study seem to be aware of the need for trained guidance workers.

3. Provisions made for training school-counselors in the thirty institutions of higher learning discussed in this study are generally inadequate.

4. The public school administrators included in this study seem to feel counselors should have broad training in guidance as a base, and specific enough

training in the study of human growth and adjustment that it will be possible to understand individual problems and their many ramifications in our social setting.

5. The school counselor described by the responding school administrators seem to be a general guidance worker, a coordinator of school guidance services, a helping arm to pupils and staff, and a technician in the use of the most commonly used guidance tools and skills.

6. The extent to which counselor-training ventures are initiated and succeed in the various colleges and universities studied seem to be related to the certification requirements of the various states.

1. Counselor Preparation, New York, National Vocational Guidance Association, 1949.

Microfilm copy of complete manuscript of 207 pages, $2.59. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1334.

EDUCATION, ADMINISTRATION

COMMITTEE EVALUATION OF FREE PRINTED INSTRUCTIONAL MATERIALS

(Publication No. 5769)

Carlisle Herbert Kramer, Ed.D.
Stanford University, 1953

The Problem and its Importance

It was the purpose of this study to investigate the current practices employed in the public schools of the United States for the evaluation and selection of free printed instructional materials, and more particularly to study the committee process as an evaluative instrument.

The almost universal use of sponsored instructional materials in the public schools of the United States, at an estimated expenditure of over one hundred million dollars per year, has been accompanied by a growing concern in the minds of educators regarding the effects which continued uncritical use of these materials could have on children, and the public school curriculum.

Sources of Data

Data for this investigation were obtained from a study of the literature on the subject, replies to personal letters written to the forty-eight state superintendents of public instruction, replies to personal letters written to city superintendents in the fifty largest cities in the United States, interviews with eighteen school district superintendents, and with appropriate personnel in the offices of two county superintendents in the California counties of Santa Clara and San Mateo, and from the cooperative efforts of nine appraisal groups in the San Francisco Bay Area.

Findings, Conclusions and Implications

State laws no longer seriously affect the distribution and use of free printed instructional materials in the public schools of the United States, board of education policies banning the use of these materials appear to be decreasing, and administrative restrictions are apparently increasing.

Few resources are available to educators who express a desire for assistance in the evaluation and selection of sponsored instructional materials.

The three major appraisal practices currently employed in the public schools to evaluate and select free printed instructional materials are as follows: (1) appraisal and selection by the superintendent and/or staff officer, (2) appraisal and selection by the individual classroom teachers concerned, and (3) appraisal and selection by committee action. The apparent trend is toward a more extensive use of the committee method of evaluating sponsored instructional materials. However, current practices include many variations of the three afore-mentioned plans.

The failure of nine appraisal groups cooperating for this study to arrive at similar conclusions regarding the quality and appropriateness of fifty items of free printed instructional material is indicative that the committee method of evaluating and selecting sponsored instructional materials is not in itself a panacea to the problems involved in this area.

Recommendations

Recommendations based upon the conclusions reached by the writer are as follows:

1. A free printed instructional materials center be established to serve as a research and experimental laboratory for the development, evaluation, analysis, and distribution of sponsored instructional materials for mutual benefit of sponsors and educators. The services to include the preparation and distribution of a periodical devoted to a thorough analysis and review of current sponsored teaching aids and designed to provide educators in the field with a guide for the accurate and rapid selection of instructional materials to meet the needs and interests of their pupils.

2. School districts prepare and establish boards of education approved policies, representing the combined efforts of educators and lay public representatives, which provide the flexibility necessary to encourage maximum use of sponsored instructional materials.

3. School districts develop planned programs for the evaluation, selection, and use of sponsored instructional materials, in keeping with a clearly defined policy, which include a program of community orientation regarding the values to be gained through the clinical use of controversial or blatantly-biased materials.

4. If the committee process is to be used as an evaluative instrument, members should be carefully selected to secure skilled representatives in all areas.

5. State departments of public instruction and county superintendents consider the feasibility of providing services and materials to educators

concerned with the evaluation and selection of sponsored instructional materials.

Microfilm copy of complete manuscript of 243 pages, $3.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1335.

THE EVOLVING ROLE OF THE EDUCATIONAL CONSULTANT IN SCHOOL PLANT PLANNING

(Publication No. 5765)

John Dalton Edwards, Ed.D.
Stanford University, 1953

In California, public school building construction is the product of several agencies and of the interaction of the many people who staff them. Among these agencies are: the local school district, the county school superintendent's office of the county in which the district is situated, the State Division of School Planning, architects, and outside consultants.

It is assumed that effective school planning involves all of these agencies. The problem is to attempt (1) to evaluate the functioning interrelationships among the various agencies in school planning, and (2) to determine the evolving role of the educational consultant. The problem is delimited to the area of developing educational specifications for the public school building program in California.

To determine the role of the consultant in school planning, three groups of school planning consultants were selected and two districts in which each group had worked were studied. A total of six school districts was involved. In each school district structured interviews were held with the district superintendent, the architect, and with personnel in the office of the responsible county school superintendent.

The following, in summary, appear to be the functions exercised by the educational consultant in developing educational specifications for a school building program: to come into the program as a recognized authority in his area; to be aware of the many problems and procedures for resolving them; to work with and through the superintendent in his relations with the various elements within and without the school system; to provide time and staff to carry on the needed research for a reasoned solution to problems; to exercise a harmonizing influence; to lend dignity to and enhance the sphere of the superintendent's area of responsibility; to move the program ahead through continuous participation and involvement; to leave the district and its personnel in a better position to carry on the everyday business of the schools when his work is finished.

Certain specific conclusions were drawn from the study; each school district had a need for assistance in developing educational specifications; the office of the county school superintendent did not participate as a regular member of the planning committee in any of the districts studied; the work of the architect was facilitated by the participation of the outside consultant; in each instance the planning extended in time from several months to over a year; no district made permanent assignment to staff positions of specialists in school planning; planning in each district was essentially a conference procedure.

To clarify roles, the writer suggests that certain functions and responsibilities be assigned as follows:

1. To the state should go the responsibility for setting minimum standards and establishing procedures to be followed by the local district in developing a building program. In addition, the state should advise the local district on the most effective use of its own personnel or suggest means of securing needed temporary or continuing assistance.
2. To the county should go the responsibility of providing administrative leadership for those districts too small to provide their own effective local leadership.
3. To the local district should go primary responsibility for providing educational opportunities. This includes planning for needed school housing. The district should assign, if possible, own regular staff members, train personnel in plans and procedures for school planning, or employ additional personnel for developing plans for own temporary or continuing building needs.

The total number of educational consultants for school planning is extremely limited, perhaps twenty are available state-wide. The primary task is to utilize most effectively these specialists to the end that school structures and facilities contribute to the district's educational program.

Microfilm copy of complete manuscript of 162 pages, $2.03. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1336.

A PARENT-TEACHER CONFERENCE PROGRAM IN THE MENLO PARK SCHOOLS

(Publication No. 5766)

Melville John Homfeld, Ed.D.
Stanford University, 1953

This study is an appraisal of the relative effectiveness of a newly initiated program of regularly scheduled parent-teacher conferences in the Menlo Park School District. It evaluates the parent-teacher conference technique against four objectives which were established by the district previous to the initiation of the conference program. The four objectives were:

1. To increase the teacher's knowledge regarding individual pupils.
2. To increase the parent's interest in the public schools of the community and in the child's education.
3. To increase the areas of understanding between parents and teachers.
4. To improve public relations for the schools in the community.

Sources of Data

The data from which the appraisal was made came from the following three sources:

1. Teachers' reports on their five best and five least successful conferences.
2. Teachers' structured and substantiated criticisms and opinions of the conferences.
3. Reports from parents involved in conferences reported on by teachers.

Summary of Findings

From the teachers' reports on conferences, both successful and unsuccessful, an average of 3.79% new behaviors were learned per conference, of which the teachers indicated that 2.49% would probably not have been learned except by the conferences. From the same source, 1.24% adjustments per conference were reported. Teachers were unable to select five unsuccessful conferences on which to report. Only sixty-eight such reports were received from twenty-four teachers even after a second try.

From the teachers' anonymous criticisms it was learned that 90.2% of them believed both parents' and teachers' understanding of the schools and children had increased. 90% of the teachers believed also that parents' attitudes toward education had improved. 86% of the teachers believed that public relations had improved, and that the conferences should be continued.

From the parents' comments it was noted that 73% of them had learned significant things about the school program. 93% reported favorable outcomes from the conferences and 96% believed the conferences should be continued.

Conclusions

The first conclusions are based on the four objectives established prior to the conferences:

1. Teachers' knowledge of individual pupils was increased.
2. Parents' interest in schools and children's education was increased.
3. Understandings between parents and teachers were enhanced.
4. Public relations probably were improved according to the evidence.

Other conclusions not objectively supported but drawn from having lived with and worked with the program were:

1. Teachers were the dominant factor in the success or failure of the conference program.
2. Parents' attitudes also had a marked effect on the conferences.
3. A sympathetic and friendly press was a valuable asset.
4. Adult community organizations can and do influence the program.

Recommendations

Schools desiring to improve their guidance programs might well benefit from planned parent-teacher conferences but should be wary of expecting them to solve all guidance problems.

A conference program should be preceded by careful planning by both the faculty and the community.

Teachers should guard against giving advice or drawing conclusions on the basis of limited knowledge.

Parent education regarding school programs can probably be done better in groups than in conferences.

Teachers should be given freedom in developing their individual conference techniques but should also be assisted in structuring the conferences.

Teachers should continue individual conferences with parents where problems lend themselves to this kind of treatment.

Parent indoctrination and education regarding conferences should be carefully planned and carried out.

All parents should be invited to participate in conferences not just the parents of problem children.

Teachers should be specifically trained in conference techniques prior to the initiation of a new program.

Microfilm copy of complete manuscript of 172 pages, $2.15. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1337.

THE CENTRAL ADMINISTRATIVE ORGANIZATION OF SMALL CALIFORNIA SCHOOL DISTRICTS

(Publication No. 5767)

Harvey R. Hood, Ed.D.
Stanford University, 1953

The purpose of the study was to discover when administrative and supervisory personnel had been or were being added in the smaller school districts of California in order to recommend the development of a central administrative organization. During the past twenty-five years very few studies have been made of small to medium size districts. This study arose from the needs and questions of the author over a period of years amplified by discussions and interviews with many superintendents of small to medium size districts.

The scope of the study is the central administrative organizations of all types of districts in California whose average daily attendance during 1949 to 1951 was between 550 and 7,000 pupils. Primary concern was related to districts whose average daily attendance of students was between 2,500 and 4,500, and whose growth during the past fifteen years had necessitated additions to the central staff. To implement the information concerning central administrative organizations, two chapters have been included: (1) the historical and legal background for the employment of professional assistants, (2) the percentage cost of central administration in California school districts.

A variety of methods were used in compiling the materials in the study. The information concerning the background of superintendents, professional assistants, and central administrative organizations of small districts was derived from the available

professional literature of books, bulletins, pamphlets, periodicals, codes and regulations. A questionnaire was mailed to 200 California superintendents to discover districts which had enlarged or contemplated enlarging the central administrative staff. A compilation of the full time administrative and supervisory staff members in 364 small to medium size districts of California was arranged in tables. Interviews were held with more than one hundred superintendents, professional assistants and central staff personnel, and a careful study was made of thirty-five districts including fifteen elementary, ten high school, and ten unified or combined districts. Finally, a case study was undertaken of two elementary districts, two high school districts, and two unified or combined districts.

Some of the significant findings were:

1. Since 1949 the growth of central administrative organizations in small to medium size districts has been phenomenal.

2. Unified and combined districts have shown the greatest activity in the employment of professional assistants.

3. Administrative organizations in districts with an a.d.a. of 2,000 to 6,000 have had the greatest growth.

4. The trend in employment of professional assistants has been toward assistant superintendents.

5. Most districts begin central staffs with curriculum and/or music supervisors.

Some of the conclusions and recommendations of the writer were:

1. Almost all superintendencies suffer from the lack of professional assistants.

2. Superintendents of small to medium size districts need to recognize the necessity for trained assistants.

3. Most districts of less than 2,500 a.d.a. cannot and will not be able to provide all the services necessary to an adequate educational program.

4. California school laws should be amended to permit all districts to employ various types of professional assistants.

5. Professional assistants should be trained in school administration.

6. The amount expended for administration must be predicted upon assessed valuations, tax rates and an educational system fitted to the needs of the particular community.

7. An average unit of number of employees in the central organization cannot be set for all districts, even if of the same size.

8. Minimums of professional assistants and supervisory personnel in small to medium size districts in California are needed. Such minimums have been recommended by the writer.

Microfilm copy of complete manuscript of 147 pages, $1.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1338.

A PLAN FOR RECOGNIZING PUPIL TRANSPORTATION COSTS IN THE PROVINCE OF ALBERTA FOR PURPOSES OF THE EQUALIZATION OF EDUCATIONAL OPPORTUNITY

(Publication No. 5772)

Gordon Leslie Mowat, Ed.D.
Stanford University, 1953

In 1936, in Alberta, Canada, there commenced a province-wide reorganization of school districts into larger administrative units called school divisions. This reorganization was accompanied by modifications in the provincial plan for financial aid which were intended to equalize educational opportunity.

In 1949, A. W. Reeves completed a study which evaluated the provincial grants plan for equalizing the financial efforts required to support the instructional program in Alberta schools.

It is the purpose of this study to augment that of Reeves by giving exclusive attention to the demonstration of a method for equalizing the costs of pupil transportation in Alberta.

The concepts which were accepted as bases upon which to evolve the plan were:

1. The delegation of rights, responsibilities, duties, and authority achieved within the political organization of the province expresses faith in the ability and intent of individuals to act in a responsible manner. The opportunities thus provided are meaningful only to the extent that administrative relationships within the hierarchy of government remain consistent with this concept.

2. The term "minimum program" implies that a desired educational program is being implemented in the classroom. Therefore, the "uniform" effort required at the local level should include the effort expended in gathering the pupils into the classroom.

3. The quantity and scope of transportation services required in a given locale depend upon the concept of what constitutes desirable education, together with the peculiar circumstances of topography, organization, and school population. Specific need for transportation services must be determined at the local level.

4. The needs for transportation services having been so determined, resultant costs become a valid factor which may be used in ascertaining the efforts required to provide the services.

With respect to measuring the relative efforts of local administrative units to provide pupil transportation services in Alberta, the selection of a method was carried out in accordance with these concepts. Predictive techniques which utilize density of population to establish both need and cost were rejected.

The method selected for this study utilized data for all school divisions in Alberta, in which the financial scope of services represented 90 per cent of the total for the province. For the fall school term in 1947, data regarding the number of busses operated, the daily cost of each, the daily load of each, and the daily round-trip mileage of each were used. Busses were grouped into four classifications according to

ratings of the Provincial Highway Traffic Control Board. Multiple regression equations were developed for each group. These equations were developed by calculating coefficients of correlation between cost and pupil-load, cost and round-trip mileage, and pupil-load and round-trip mileage; subsequently, using these correlations, other derived values were combined into equations. As such, they were considered to be standards which reflected from actual practice the mean effects of the variables pupil-load and round-trip mileage upon daily cost.

The implementation of the plan involved application of the standards back to the original data from which they were developed. These calculations represented the recognized costs to be used for the distribution of equalization aid for pupil transportation. The total cost recognized for an administrative unit was divided by the value of the minimum program, and the equivalent classroom units thus derived were added to the number of operating classrooms for incorporation into the total equalization program.

Because the use of standards causes recognized costs to exceed or be less than actual costs, the differences involved may create detrimental variations in the effective rate of local effort. The actual effect was found to be less than .8 mills in 47 of the 49 divisions, a condition accepted as non-detrimental. The long-term effects of the proposal were acceptable as judged against Covert's criteria, published in 1946.

It was stated that the further effect of the proposal would be to stimulate and create needs for:

1. The development of guides by which to determine what constitutes adequate transportation in a given area;
2. The development of uniform and accurate accounting procedures for all aspects of pupil transportation in Alberta;
3. Understanding the conditions and practices which may make public ownership of transportation systems educationally and economically desirable;
4. Informed and competent local administration of pupil transportation in Alberta.

Microfilm copy of complete manuscript of 206 pages, $2.58. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1339.

THE CONTRIBUTION OF THE SUPERINTENDENT'S BULLETIN TO THE SCHOOLS' PUBLIC RELATIONS PROGRAM

(Publication No. 5773)

Oscar Bernhardt Paulsen, Ed.D.
Stanford University, 1953

The purpose of this study was to determine the uses for which school bulletins are published in the United States and to determine the readership value of the bulletin to local parents.

Procedure

The study included a survey of literature in industrial public relations, journalism, and school public relations; an analysis of the opinions of school administrators in the United States as to the use of school bulletins; an analysis of the opinions of parents as to the value of school bulletins; a study of the make-up, content, distribution, and frequency of publications; a study of cost factors; and a study of the adequacy of newspaper coverage of school news.

Findings

The superintendent's bulletin was found to be a contribution to a school public relations program. The cost of the local bulletin was found to be small in comparison to the benefits received as measured by parental opinion.

Information about the educational progress of children was found to be the most important element in school public relations. Parents reported that they discussed school problems with their children more than with anyone else. They regarded their children as reliable sources of school information. Parents were more concerned about their children than they were about school problems.

School administrators were more concerned about the immediate pressing school problems, such as shortages of finances, school-housing, and of teachers caused by the increased population in the school districts.

Both parents and school administrators were almost unanimous in approving the use of a school bulletin as a part of the school public relations program. They regarded the school bulletin as a valuable medium of communication through which school information of concern to the public could be distributed.

Recommendations

The study supports these recommendations: 1. A program of public relations is needed to combat attacks on public schools. 2. Educational literature indicates that the school administrator should establish communication with the publics in his community. 3. The school public-relations program should be based upon certain principles, and the techniques used to carry it out should be carefully selected and planned. 4. Photo-journalism is recommended for use in public relations. 5. The bulletin should be used to influence public opinion. 6. The bulletin should emphasize the educational progress and health of children. 7. Children should be given school information so that they may discuss school problems intelligently. 8. The superintendent's bulletin should be used in place of, or as a supplement to, an annual report. 9. School administrators should express their views on problems affecting schools and children. 10. The bulletin should be used to secure support for bond and tax elections. 11. The multilith duplicating process is recommended. 12. Monthly distribution is recommended. 13. The bulletin should be used as an independent means of communications supplementing newspaper coverage.

Microfilm copy of complete manuscript of 224 pages, $2.80. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1340.

THE ROLE OF THE PRINCIPAL IN CURRICULUM DEVELOPMENT

(Publication No. 5774)

Clarence Eugene Petersen, Ed.D.
Stanford University, 1953

The role of the elementary principal in curriculum planning and development was studied in thirty-three selected urban elementary schools in California and compared with the ideal role described by selected authors writing on the elementary principalship and on curriculum planning and development. This comparison considered gaps, inadequate treatment, consistency, and unusual contributions in practice. Practices in selected schools were described as illustrative of what can be done in curriculum development.

The schools selected were in eight districts considered by a board of twelve judges from the California State Department of Education and the Stanford University School of Education to be doing the most significant work in curriculum development at the time. Principals were chosen by local officials as those most actively engaged in curriculum development at the time of the visitation.

The bulk of the data was collected in personal interviews and observations. Approximately one-hour interviews were held with each of the principals and with twenty-one central staff members. Observations were made in 170 classrooms selected by principals as places where the writer might see some evidence of the principal's help in curriculum development. Printed curriculum materials were examined. Data were recorded by the immediate recall method. A day was spent in each of the thirty-three schools.

Five main aspects of the ideal role of the principal in curriculum planning and development were extracted from the literature recommended by advisers and were compared in theory and practice:

1. Selecting and initiating curriculum projects.
2. Providing instructional materials and facilities.
3. Implementing the work of teachers through:
   (a) Developing a wholesome group atmosphere
   (b) Providing time for curriculum work
   (c) Providing opportunities for teachers with common problems and interests to share ideas
   (d) Arranging intra- and inter-school visits for teachers
   (e) Arranging workshops
   (f) Coordinating supervisory services
   (g) Observing instruction and conferring with teachers
   (h) Utilizing in-service training opportunities
   (i) Organizing study groups
   (j) Developing the principal's own competence
4. Adapting the curriculum to the needs of atypical children (here considered to be the physically handicapped, the mentally retarded, and the mentally gifted).
5. Working with the central office staff.

Further comparisons were:

1. Theoretical concept of the curriculum and the concept consistent with practice.
2. Importance of the individual school in theory and practice.
3. Preparatory training and experience recommended and reported.

Professional references found most helpful, activities during the previous week, and problems encountered were also reported. Illustrative cases showing the relationship between what the principals reported and what was observed in the classrooms are described in the dissertation.

In aspects other than those mentioned below, consistency was found between theory and practice. Gaps or inadequate treatment in practice were noted in (a) the concept of the curriculum consistent with practice, (b) the autonomy granted to the schools, (c) the manner of selecting curriculum projects, (d) the provision of materials and facilities, (e) the time provided for curriculum work, (f) teacher visitation programs, (g) summer workshop programs, (h) classroom observations, and (i) teacher-principal conferences. A wholesome group atmosphere was noted in the schools visited and was reflected in statements made by the teachers. In comparing this aspect of the role of the principal in theory and practice, an unusual contribution was found in practice.

Had the schools been less highly selected, it is probable that more serious gaps between ideal and actual practices would have appeared. This should concern those responsible for the preparation, certification, selection, and in-service training of elementary principals. The study highlighted three further needs:

1. Extension of the period of service required of principals and teachers to allow time for more thorough curriculum development.
2. Increased autonomy for individual schools.
3. Assignment of more administrative details to assistants thus freeing the principal for curriculum development activities.

Microfilm copy of complete manuscript of 211 pages, $2.64. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1341.

A SYNTHESIS OF THE PHILOSOPHIES AND CONCEPTS OF STAFF IN THE ORGANIZATION OF BUSINESS, GOVERNMENT, AND EDUCATION

(Publication No. 5818)

Joseph Marshall Trickett, Ph.D.
Stanford University, 1953

Groups of people do not "automatically" accomplish their desired ends in the most effective or efficient manner. Hence, observers in a wide variety of fields

have long pointed to the importance and universality of organization in all human group activity. One of the major purposes of this study is to portray some of these organizational precepts and concepts — particularly as developed in the literature of business and public administration — and to indicate parallels as to their general applicability in educational administration.

The literature of business organization shows a wide variety of interpretations and concepts concerning staff and its uses. Much disagreement centers around the nature of "staff authority" and around the comprehensiveness or meaning of the term "staff."

The literature of public administration, likewise, has a considerable variety of organizational interpretations. While the use of staff in government is as old as government itself, the question of line authority versus staff authority frequently remains unanswered. A concept of "dual authority" (line and staff) is more readily accepted in government than in business. There is in public administration, however, a well-developed and generally available body of organizational and administrative theory.

The literature of educational administration reveals little clear-cut thinking pertaining to staff organization in comparison to such material in business and government. There are expressed needs for staff services and descriptions of specialization and functionalization, with little or no recognition of comparable developments in other fields. The question of amount and extent of staff authority exists in education as it does in business and government, but is not usually so-recognized. A more or less intense opposition to "administration" in general and to "line and staff organization" in particular is revealed throughout educational literature.

Undoubtedly, much of the seeming contradiction among administrative theorists is concerned with non-uniform meanings and definitions. Hence, for purposes of clarification, staff is here defined as including all activities not directly concerned with achieving the basic purposes of the organization; it is shown to be intrinsic in all organization. Four distinct types of staff are discernable: "Personal," "Advisory-Service," "Facilitative," and "Directive." A clear understanding of these types of staff activity and their proper use can do much not only to effect sound organization but to preclude or minimize the often serious, line-staff conflicts. This will permit the integration and coordination of line and staff at all levels in the organization.

Finally, a number of implications and conclusions can be drawn which may be of value to administration in general and to educational administration in particular. Thus, writers on educational administration should become more familiar with the general literature and philosophy of administration. They will, thereby, realize that education, as a human group activity, is not greatly different from other group undertakings. Further, the myth that good administration and good education are antithetical must be dismissed for all time. A parallel misconception to be abandoned is that effective organization and proper use of line and staff are in any way nondemocratic or otherwise undesirable. Educational organization must identify and utilize staff activities; in fact, school and college administration must provide for the development of sound, dynamic, and planned organization structure. Education at all levels needs the type of attention to organization as that which is provided in our federal government, in the military, and in our best-managed business institutions. Organization planning is a continuous process....

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EDUCATION, ADULT

PARTICIPATION IN ADULT GROUPS: THE RELATIONSHIP BETWEEN PARTICIPATION AND VALENCE IN TWO AIR FORCE RESERVE SQUADRONS

(Publication No. 5693)

Clifford Louis Larsen, Ph.D.
University of Michigan, 1953

The purpose of this study is to investigate selected factors related to (a) attendance at squadron meetings and (b) participation in squadron and Air Force activities by members of two Air Force Reserve squadrons.

The study is made of two Air Force Reserve squadrons, located in Ann Arbor and Jackson, Michigan. Seventy-four members of the Ann Arbor squadron and seventy members of the Jackson squadron were given or mailed a four-page questionnaire. The questionnaire was designed to obtain the following information: (1) valence of the Air Force for the member, (2) valence of the squadron for the member, (3) rank order of attractions to the Air Force and (4) rank order of attractions to the squadron. The attendance and participation record of each respondent was obtained from the Air Force records for a period of seven months.

The analysis is based upon the information received from 138 returned questionnaires (95%). The independent variables, valence and sources of attraction to both the Air Force and the squadrons are related to attendance and participation in squadron functions.

It is found that the valence of the squadron is a better indicator of attendance at squadron meetings than is valence of the Air Force Reserve. Likewise, the squadron valence is a better predictor of participation in squadron activities than is Air Force valence.

The sources of attraction to the squadron which are selected by the respondents are (1) means-control, i.e., the group is seen as a provider of a path to a personal goal, and (2) activities of the squadron. Means-control as a source of attraction to the squadron is found to be valuable as a predictor of attendance

and participation. This finding lends support to a point of view suggested in previous research.

The major source of attraction to the Air Force is a feeling of patriotic duty to belong. Patriotic duty as a source of attraction to the Air Force is not related to attendance and participation in the squadron with a high degree of probability.

All relationships are tested by chi square.

The conclusions are as follows:

1. The valence of the group to be attended i.e., the squadron, is related to attendance and participation behavior with a higher degree of probability than the valence of the larger group (Air Force).

2. The degree of attraction to the squadron of any single source of attraction is positively related to attendance and participation behavior of the member.

3. Outside pressure as a source of attraction to the squadron is found to occur infrequently.

4. Outside pressure (patriotic duty) as a source of attraction to the Air Force Reserve is found to occur frequently, thus pressure may account for joining the larger group but not likely to be related to attendance or participation in the squadron.

5. The greatest dissatisfaction with the squadron is shown to be a dislike for the activities of the squadron.

The general conclusions of this study are not limited to Air Force Reserve squadrons alone. Rather, many of the factors found to be related to participation are generalizable to many groups with important implications for adult education.

Microfilm copy of complete manuscript of 80 pages, $1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1343.

FUNCTIONS OF METHODOLOGY IN ADULT EDUCATION CERAMICS COURSES

(Publication No. 5775)

John G. Shrock, Ed.D.
Stanford University, 1953

The purpose of this study is to investigate certain behavioral outcomes of a selected adult education course in ceramics and to explore the utility of certain evaluating instruments which give immediate measures and useful indication of changes in the adjustment of individuals over a period of time. Authorities on adult education report a great need for research investigating the emotional components of adult education classes.

A city of approximately 35,000 inhabitants with 4,010 persons attending classes at an adult education center was selected for the investigation. Nearly one hundred students were enrolled in the ceramics classes during the fall quarter of 1952 when the study was made. Two teachers with differing methods and philosophies taught these classes.

A total of 66 women ranging in age from 20 to 65 years volunteered to participate in the study. An experimental group of 34 persons and a control group of 32 persons were designated in terms of the teachers under whom they studied. The experimental group was taught by a male teacher who is primarily an artist whose methodology embraced complete freedom of self-expression, a minimum of discipline except that of the limitations of material, and a prohibition of copying from examples of pottery previously constructed. The control group was taught by a woman of wide teaching experience who used a comparatively conventional method and philosophy of teaching in which there was more emphasis on discipline of form and technique and a closer adherence to standards set up by experts of the past and present.

It was hypothesized that no differences in adjustment would exist between the two groups at the end of the experience, that there would be no significant changes in adjustment within either group, and that any differences or changes observed were related to the differential methodology of the two teachers. The method of analysis involved testing the null hypothesis. A pre-experience questionnaire, the Kuder Preference Record-Personal and Guilford's Inventory of Factors STDCR were administered at the initial point in the experiment. A post-experience questionnaire and the Guilford instrument were given ten weeks later at the close of the quarter.

An analysis of the first questionnaires was made for the purpose of comparing the two groups and describing the composition of each group. No significant differences were found between the groups in age, sex, marital status, number of children, and educational level. The mean scores of the two groups on the Kuder were not significantly different. A technique for obtaining the sampling error via differences in scores of 32 members of each group matched for initial scores, sex, age, and educational level was used in the analysis of the data derived from the Guilford Inventory of Factors STDCR.

For the control group no statistically significant differences were found between the pre- and post-test scores on the Guilford. Differences significant at the 5 per cent level for factor D and at the 1 per cent level for factor C were found to exist in a favorable direction for the experimental group. Inter-group comparisons at the end of the experiment show no significant differences between the groups except for factor C in favor of the experimental group. This difference is significant at the 1 per cent level.

It is concluded that functions of methodology in adult education ceramics courses include changes in certain factors of personality which are related to the differential methods and philosophies of the teachers. The major value of this study is the exploration of a method for evaluating such intangible outcomes as those described above.

Microfilm copy of complete manuscript of 141 pages, $1.76. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1344.

THE PREPARATION AND EVALUATION OF RECORDINGS USED AS DISCUSSION STARTERS WITH ADULT GROUPS

(Publication No. 5746)

Helen Kathaline McCall Tewes, Ed.D.
University of Michigan, 1953

The purpose of this investigation was to prepare and evaluate recordings used as discussion starters with parent groups.

The population used consisted of 588 adults who were members of twenty-six different groups ranging in size from 7 to 64 members and located in Ohio, California and Michigan.

Skits were written and recorded with the idea that they should portray common experiences, controversial issues and educational concepts of concern to parents in problematic situations.

The recordings were evaluated by the members of the various groups taking part in the investigation. An evaluation sheet of eight questions covering interest, reality, fidelity, identification, motivation, group involvement, participation and effectiveness was given them to check on a five-point scale. These ratings plus personal information about each individual provided the data of the study.

The data indicate that:

1. The ratings on all questions except one tended to be average or above. The exception is question 4, "Could you see yourself in this situation?" which tended to fall slightly below average.

2. The crude or inspectional mode for each evaluation question was higher than the mean.

3. In all groups from 70 to 100 per cent of the members took part in the discussion, with the exception of one group in which 50 per cent took part.

4. Parents participated in discussions to a greater extent than did non-parents, non-professional persons more than professional, and men more than women in mixed groups. There was a consistently higher per cent of participation in groups of less than twenty than in groups of twenty or more.

5. Parents, non-professional persons, and men appeared to rate the recordings higher as discussion starters than did non-parents, professional persons and women. Group size had little effect on this rating.

The results support the following conclusions:

1. The recordings were effective discussion starters.

2. The recordings lessened the need for a trained leader.

3. A variety of problems within a skit helped different individuals to identify themselves with situations portrayed and tended to promote discussion.

4. Individuals resist identification with undesirable situations but indicate an interest in correcting problematic situations.

The report of the study includes the complete scripts and manuals of three records. They are entitled "Report Card Dilemna," "Mrs. Green Goes Shopping," and "Meal Time Trouble." Tape and disc recordings of each skit are filed at the Audio-Visual Education Department of the University of Michigan.

Microfilm copy of complete manuscript of 247 pages, $3.09. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1345.

EDUCATION, HISTORY

THE ATTITUDE OF ORGANIZED FARM GROUPS TOWARD EDUCATION IN MICHIGAN

(Publication No. 5738)

Clarence Albertus Sommer, Ph.D.
University of Michigan, 1953

The purpose of this work is to examine the attitudes that organized farm groups have taken toward education in Michigan since the organization of such groups about 1845, to determine why these attitudes have been adopted, and to evaluate the effect of these attitudes on public education. The study is limited to those organized farm groups of recognized standing in the state. It does not purport to show the attitude of every farmer toward education. An analysis has been made of the literature of these groups, of the pronouncements of their leaders, and of the activities of non-farm organizations, in order to evaluate the attitudes of farmers and the reasons for them.

The strength in membership and the prestige of the Michigan State Agricultural Society, the Michigan State Grange, the Michigan State Farm Bureau, and the Michigan State Association of Farmers Clubs indicate that these have been the influential farm groups in the state. Other Michigan organizations of farmers seem to have had little influence upon the educational policies of the state.

The study reveals that the selected farm groups have approved the following educational policies:

1. The limitation of the electoral franchise to property owners within the school district

2. The increased, but not complete, state-wide financial support of education

3. The local control and supervision of rural schools

4. The consolidation of local school districts only through the cooperation of rural residents

5. Rural representation on area studies committees

6. The control of programs and research at Michigan State College

Farm groups have insisted throughout their existence that only through the local control of rural education will the schools meet the following requirements.

1. The provision for educational experiences which will give youth a suitable training for rural life;

2. A sound appreciation of the customs and ideals of rural people

3. The employment of teachers who understand the nature of rural citizenship and are able to give suitable guidance for it.

They have also maintained that the farm population must exert considerable control over Michigan State College to insure training for progressive agriculture and the research necessary to achieve it.

Farm groups have desired to make the financial support of education state-wide because they have believed that property taxes are inequitable and discriminatory and that they penalize the property owner while some other groups which benefit from education are not taxed for this service. They have argued that

since education is a function of the state, its support should come largely from the state as a whole rather than from local school districts.

Microfilm copy of complete manuscript of 130 pages, $1.63. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1346.

REGIONALISM IN SOUTHERN HIGHER EDUCATION

(Publication No. 5749)

Caesar Francis Toles, Ph.D.
University of Michigan, 1953

On February 8, 1948, an interstate compact was formed by the Southern Governors' Conference at Wakulla Springs, Florida. This compact established the legal base for the creation of a new educational agency to facilitate regional arrangements for higher education in the South. The new educational agency is known as the Southern Regional Education Board, and has headquarters in Atlanta, Georgia. The stated purpose of the Board is the "improvement of graduate and professional education, and by this means, improvement in the general level of living." The method used by the Southern Regional Educational Board is "extensive resort to interstate and inter-institutional cooperation of a voluntary nature."

The purposes of this study are:

1. To determine the relationship between the concept of regionalism as exemplified in the educational arrangements made by the Southern Regional Education Board, and the older, historical concept of cultural, intellectual, and economic sectionalism which developed in the South between 1819 and 1848.

2. To characterize regionalism and sectionalism, and to determine whether regionalism constitutes sectionalism, and in actual application, serves sectional ends.

3. To determine whether in the light of recent United States Supreme Court decisions respecting the higher education of Negroes, the regional arrangements of the Southern Regional Education Board, are legally applied in the field of higher education.

A visit was made to the home office of the Southern Regional Education Board where its Consultant for Professional Programs and other members of the staff were interviewed. The literature of the Board published and unpublished was examined. Lay members of the Board representing the Negro race were interviewed. Reactions to the establishment of the Board as revealed in the public press were examined. The publications of protest groups among Negroes were studied, and compared with those of Southern white liberal groups. Examination was made of the reaction of the United States Congress to the formulation of the interstate compact by the South Southern Governors' Conference. Results of surveys made by the Southern Conference Educational Fund, Incorporated, of New Orleans, Louisiana, to determine attitudes of students, college teachers, and university professors toward the admission of Negro students to the graduate and professional schools of Southern white universities, were studied. Basic works on the history of the South, written by Northern and Southern historians were examined.

Three general conclusions can be drawn from the study.

1. The concept of regionalism as exemplfied in the educational arrangements of the Southern Regional Education Board, is related to historical sectionalism which developed in the South between 1819 and 1848.

2. Regionalism in actual application, serves sectional ends as revealed in the educational arrangements of the Southern Education Board and by the Board's adherence to the segregated policies of Southern institutions.

3. In the absence of a United States Supreme Court decision declaring segregation unconstitutional, the educational arrangements of the Southern Regional Education Board, can be legally applied in the field of higher education.

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EDUCATION, PHYSICAL

THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON HEART RATE, DEEP BODY TEMPERATURE, AND PERFORMANCE IN SWIMMING

(Publication No. 5519)

Donald Dwight Adee, Ph.D.
University of Minnesota, 1953

The Problem

The purpose of this study was to determine the optimum water temperature for maximum performance and minimum stress on the physiological factors influencing performance, heart rate and body temperature.

The object of the experiment was to test the hypothesis that there is no difference in the performance of, or in the physiological stress on swimmers, regardless of the water temperature in which they are tested.

Design of the Investigation

Each of the seven subjects were tested four times at each of seven water temperatures during a fifty-six day testing period under controlled conditions. A seven by seven Latin Square arrangement was used for the four tests by superimposing the squares for the second, third, and fourth tests over the Latin Square for the first test. The completed Latin Square design determined the order of testing and order of temperature control. The environmental temperatures used were 64,69,74,79,84,89, and 94° F. The

tests included the 50 yard dash, 1500 meter swim and a a twenty minute swim at a constant rate.

The measurements made on each subject at each pool temperature were: 1. heart rate at rest, 2. body temperature at rest, 3. heart rate after the 50 yard dash, 4. body temperature after the 50 yard dash, 5. 50 yard dash performance time, 6. 1500 meter performance time, 7. heart rate after the endurance swim, 8. body temperature after the endurance swim.

Results and Conclusions

1. Water Temperature and Recovery Pulse Rate.

a. There was no significant difference in recovery pulse rates after swimming the 50 yard dash in water temperatures ranging from 69 to 94° F.

b. The recovery pulse rate was significantly increased with increasing water temperature after both the 20 minute pace swim and the competitive 1500 meter swim.

2. Water Temperature and Rectal Temperature.

a. The rectal temperature increased significantly with increasing water temperature in all tests.

b. As would be expected, from the high specific heat of water, pool temperature is a more important determinant of rectal temperature and therefore of performance of man than are similar changes in atmospheric temperature.

c. Since it is generally recognized that rectal temperature is a determinate of pulse rate (in this case r = .90) it is believed that water temperature is an important controlling factor in determining cardiovascular performance during swimming.

3. Water Temperature and Performance.

a. The 50 yard dash was best performed in the warmer temperatures (84 to 94° F.).

b. Endurance was best in the intermediate water temperatures of 74 and 79° F.

c. In both the dash and endurance events the best performance occurred when the rectal temperature after exercise was approximately 101° F.

Reasons are presented for believing that stiffness associated with high muscle viscosity is a limiting factor when the men worked at lower rectal temperatures and that poor cardiovascular performance became a limiting factor in the endurance events when the men worked with higher rectal temperatures.

Microfilm copy of complete manuscript of 230 pages, $2.88. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1348.

A STUDY OF THE DYNAMOMETER STRENGTH OF ADULT MALES AGES 30 TO 79

(Publication No. 5664)

Richard Joseph Donnelly, Ph.D.
University of Michigan, 1953

The problem of this dissertation was to investigate the dynamometer strength of adult males 30 years of age and older.

A total of 534 adult males between the ages of 30 to 79 were tested and interviewed. Of the men tested and interviewed, 242 were members of the Detroit YMCA's, 25 were factory workers at Hoover Ball & Bearing Company in Ann Arbor, Michigan, 15 were residents of a farming community (Allen, Michigan), 29 were faculty members and graduate students of the University of Michigan, and 223 were inmates of Southern Michigan Prison.

The following information was taken experimentally: dynamometer strength for right and left grip, arm pull and arm push, and back and leg lift. The height and weight of each subject were also recorded. Data concerning the subjects' occupation and their recreational sports participation were secured by interview.

The data were analyzed graphically and statistically. The strength index (body weight/strength in pounds) was used in all statistical work. IBM machines were utilized in the computations.

Average strength was computed for eight age brackets on the basis of five-year spans to age 59 and of ten-year spans from 60 to 79. Percentile tables were made for ten-year age brackets for the different strength test items. A regression formula was also computed for the five indices.

The subjects were grouped into four categories of sports participation strenuousness: light, moderate, heavy, and none. The dynamometer strength of these four groups was compared to determine the effect of sports participation upon strength as tested by the dynamometer. Occupation strenuousness and athletic experience of subjects were also compared with dynamometer strength for the same purpose.

The evidence showed that an adult attains maximum dynamometer strength in his thirties. The marked decline in dynamometer strength commences between the age of 37 and 42. As a person grows older he loses his hand and arm strength more rapidly than his back and leg strength.

The conclusions of the study are as follows: (1) The relationship between dynamometer strength and age is negative. (2) Adults who participate in recreational sports are stronger than non-participants, but the difference is not great enough to be statistically significant. (3) Strenuousness of a person's occupation has no significant effect upon the relationship between dynamometer strength and sports participation. (4) Among the men who do not participate in recreational sports the ones who were athletes in high school or college are stronger in back and total strength than the non-athletes. (5) Weaker individuals lose a greater proportion of their strength than the stronger ones.

Microfilm copy of complete manuscript of 148 pages, $1.85. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1349.

EFFECT OF KNEE TRAUMA ON GAIT

(Publication No. 5471)

Jeannette Julia Gund, Ph.D.
State University of Iowa, 1953

The subjects of this study were undergraduate and graduate college women whose ages ranged from eighteen to forty years. The total group of thirty-seven subjects was divided into two categories. One group included individuals with past history of knee injury, but no hip or ankle trauma. The other group included individuals who to their knowledge had had no injury involving the knee, hip or ankle.

The purpose of the problem was to establish a procedure for recording gaits which would enable the writer to make analyses and evaluations of the gait patterns, and to make certain measurements of the gait pattern.

Motion pictures were utilized to record the gait patterns of the subjects. A two-camera arrangement was planned to allow for simultaneous filming of the side and back views and thus eliminate the possibilities of changes in the gait pattern which might occur on successive filming of the two views.

The investigation comprised two phases. The first involved the tracing of selected frames from the motion pictures and the plotting of specific angles and distances for measurement purposes. The second part involved evaluation and analyses of the recorded gait patterns by selected individuals from the physical education and medical professions.

Careful study of the measurements made on the film tracings and of the anthropometric measurements reveals only limited differences in the groups. No definite pattern seems to follow through the various measurements for any one group, and the number of cases is much too small to attempt to generalize on the small differences obtained.

The evaluation and analysis of films was valuable in that it afforded an insight into the gait pattern and the gait characteristics which made up this pattern. There seemed to be no typical gait characteristics for any type of injury group which were not also evident in other groups or in the normal group. However, there seems to be a greater degree of rotation in the injured groups than in the normal group.

The use of the motion picture technique and the treadmill is an excellent means of recording gait patterns for purposes of analysis.

Microfilm copy of complete manuscript of 91 pages, $1.14. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1350.

LOUIS HORST: HIS THEORIES ON MODERN DANCE COMPOSITION

(Publication No. 5712)

Esther Elizabeth Pease, Ph.D.
University of Michigan, 1953

The purpose of this investigation is to record the theoretical concepts of a method for teaching dance composition as it has been formulated by Louis Horst, one of the pioneers in the development of the American modern dance. The study aims to establish the importance and significance of Horst's contribution to a contemporary art and to reveal the parallelisms he has emphasized as existing between the composition of music and the composition of dance and the interrelatedness of all contemporary art.

Data were collected by means of tape-recorded conversations with the subject on previously prepared topics selected by the writer. These were supplemented by excerpts from Horst's own volume on dance composition, from the few articles he has published, and from notes taken by the writer during his classes. Certain material photostatted from the scrapbooks Horst has been maintaining since 1915 was included because of its historical interest.

The first chapters deal with events leading up to the development of Horst's theories: his musical background, his experiences as musical director for the Denishawn company, his collaboration with Martha Graham during the experimental period when there was a need to find a new idiomatic expression in dance in keeping with the contemporary movement in the other arts, and Horst's first teaching experiences.

Chapters III and IV are devoted to a discussion of the importance of form and content in composition and ways by which the choreographer can arrive at an understanding of these. Horst considers a knowledge of form basic to an understanding of the dance art — that it should be the first discipline of the dance composer. Not until the artist has developed the habit of working within a structural form is he prepared to give primary concern to the content of his composition.

The succeeding chapters record in detail Horst's analysis of the basic elements of dance as they parallel the basic elements of music — rhythm, melody, and harmony — as well as a description of the two courses in dance composition that he teaches. These are followed by a chapter on the rules of criticism that Horst employs in measuring the worth of a new dance and a brief discussion of the principles he considers essential in the selection of musical accompaniment for dance.

In summarizing the uniqueness of Horst's contribution to the contemporary American modern dance, the study concludes that many of the theories of music composition which he has applied to dance composition are of practical value and can be adapted for use by teachers and students of the modern dance at secondary and higher levels of education as well as by the professional dancer. In any creative medium, according to Louis Horst's premise, the individual must learn to synthesize his emotional and intellectual

reactions to his contemporary existence and to reveal his ideas through a conscious and skillful manipulation of his own craft.

Microfilm copy of complete manuscript of 159 pages, $1.99. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1351.

EDUCATION, PSYCHOLOGY

THE RELATIONSHIP OF THE AUDITORY AND VISUAL VOCABULARIES OF CHILDREN

(Publication No. 5779)

Hubert Coslet Armstrong, Ph.D.
Stanford University, 1953

The auditory and visual vocabularies of a sample of two hundred children aged six to twelve were investigated. The Stanford Binet Vocabulary Test, which is a sample of an 18,000-word dictionary, was the measuring instrument. Each word was first shown visually, for oral definition. A creditable response was scored as visual vocabulary. The oral responses to visual presentation indicated, in addition, however, that the word was also known in auditory form. If a word was not recognized visually, and defined, it was then pronounced. If defined creditably it was scored as auditory-only vocabulary. A third score was obtained for total auditory vocabulary, which is the sum of the words known in auditory form as indicated by the oral responses after visual presentation, plus those known in auditory form only.

The data were classified by age intervals of one year, for ages six to twelve inclusive. The data were analyzed to indicate: (1) the relation of the three above scores to age; (2) the significance level between "visual" and "total auditory" vocabularies; (3) the extent of inter-individual differences; (4) the extent of intra-individual differences as measured by the "auditory-only" vocabulary; and (5) the relation between "visual" vocabulary and scores on the Stanford Reading Test.

The results of the research indicate, for the sample of children tested, and for "vocabulary" as defined by the dictionary sampled, that "total auditory" and "visual" vocabularies may be measured and distinguished with high statistical significance for ages six to ten, and with a significance level of .03 or greater at ages eleven and twelve.

Smoothed curves, based on age means, indicate that "total auditory" vocabulary increases arithmetically from a vocabulary of 2,900 words at age six (ages indicate mid-year values, i.e., six years, six months) to 7,720 words at age twelve. "Visual" vocabulary increases in semi-geometric fashion from 648 words at age six, to 7,588 words at age twelve. The standard error of measurement varies from about 225 words for the younger ages to about 600 words for the older years.

The range of inter-individual differences, as measured by the middle ninety per cent of the age groups, (1.645 standard deviations from the mean) varies from about one-half, to nearly twice, the difference between the means of age six and age twelve.

Intra-individual differences as measured by "auditory-only" vocabulary, decrease with age. The range of the middle ninety per cent is greatest during the middle years of elementary school, and it varies from a range of about 1,400 words at ages six and twelve, to about 3,400 words at age eight.

"Visual" vocabulary scores correlate .88 with Stanford Reading Test scores, with age controlled.

The results of this study suggest that these two modes of vocabulary may be measured by means of a scale to estimate "total" defined vocabularies in absolute units of the universe of words sampled. Such a method has implications for teaching, since for example, auditory vocabulary may be used as a criterion of improvability in reading. The findings also have implications for the measurement of reading achievement, for constructing and evaluating teaching materials, for the diagnosis of deviate cases, and for school administration.

The method employed in this study has implications for further research in extending the present study to other age groups and also to other modes of vocabulary and language. Studies of the relation of vocabulary to other allied problems might be profitably made by using a scale for estimating absolute units of a defined universe of words.

Microfilm copy of complete manuscript of 148 pages, $1.85. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1352.

THE RELATIONSHIP OF THE PERSONALITY FACTOR OF DEPENDENCE TO PSYCHOLOGICAL INVALIDISM IN WOMEN FOLLOWING RADICAL MASTECTOMY

(Publication No. 5410)

Morton Bard, Ph.D.
New York University, 1953

It was the purpose of this investigation to determine the relationship of life adaptations and the personality factor of dependence to emotional reactions and psychological invalidism following radical mastectomy for breast cancer. This study was needed because of the noted increase in psychological invalidism following cancer surgery, particularly radical mastectomy. Physicians and surgeons concerned with the management of the post-operative cancer patient are interested in ascertaining whether post-operative invalid reactions are related to personality and whether invalid reactions can be predicted before surgery.

The subjects of this study were twenty white females who were diagnosed as having carcinoma of the breast at Memorial Hospital in New York City. The subjects were between the ages of twenty-eight

and fifty-seven years, free of menopausal or physical symptoms other than those related to breast cancer, and had negative psychiatric and surgical histories.

The life adaptations and personality factor of dependence were evaluated prior to operation by a psychological battery consisting of the Rorschach Test, Thematic Apperception Test and a Focused Interview specifically designed for this study. Each subject was selected on the day that breast cancer was diagnosed and radical mastectomy was prescribed as the treatment. Each subject was interviewed immediately after the diagnosis was established. The pre-operative psychological tests were administered on the day of hospital admission which was also the day before surgery. The interview and tests were administered by the investigator and always in the same sequence.

During the six day post-operative hospitalization period, each subject was observed by a recreational therapist who noted the activity patterns of the patient on a form provided by the investigator. Not less than six weeks nor more than ten weeks after discharge from the hospital, each subject was interviewed by the investigator for the purpose of establishing the nature of psychological invalidism as indicated by emotional reactions and restriction of function.

Statistical analysis of the data by the rank-order method revealed that judges can reliably rank interpretations of dependence based on the Rorschach Test, Thematic Apperception Test and Focused Interview. Analysis revealed also a lack of communality among the three pre-operative techniques with regard to the personality factor of dependence. It was found that the extent of dependence determined by the Rorschach Test and the Thematic Apperception Test was related, but not significantly, to the extent of invalidism determined by the post-operative technique. On the other hand, the extent of dependence as determined by the pre-operative Focused Interview was significantly related at the five per cent level to the extent of invalidism as evaluated by the post-operative technique.

On the basis of these findings it was concluded that the psychological techniques employed in this research could reliably identify the personality factor of dependence. There was a relationship between personality dependence and psychological invalidism following radical mastectomy. However, although dependence could be determined on the basis of all the pre-operative psychological techniques, only the evaluations derived from the pre-operative Focused Interview were significantly related to the criterion of invalidism. The Rorschach Test and Thematic Apperception Test evaluations of dependence were related to the criterion of invalidism but not significantly. Although these conclusions were restricted to the group studied, there was sufficient evidence to suggest that future investigators refine the techniques employed in this research and vary the methodology in order to develop further psychological procedure to enable prediction of post-operative invalidism.

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THE EFFECT OF DIFFERENTIAL REINFORCEMENT ON CONCEPT FORMATION

(Publication No. 5857)

Finley Carpenter, Ph.D.
Indiana University, 1953

I. Purpose

A psychological experiment was designed to determine the effect of different proportions of reinforcement on the efficiency of concept formation. Instead of the more common qualitative approach, methods and rationale found in studies of "simpler" learning were adopted. Analysis of results was made in terms of educational implications.

II. Procedure

Ninety-two graduate students were asked to select eight wooden blocks from a pool of 19 to complete the membership of two classes. (A set of Vigotsky or Hanfmann-Kasanin Blocks were used.) A sample block for each class was used as a guide. Stimuli differed in such dimensions as color, size, height, and shape. The subject had to combine the dimensions size and height to achieve correct classification.

Group I consisted of subjects receiving 25 per cent reinforcement to all correct responses. The words "that one is right" was assumed to be reinforcing. Each succeeding group received a doubled amount of reinforcement over the preceding group, that is, Group II received 50 per cent, Group III, 100 per cent, and Group IV, 100 per cent plus the words "that one is wrong" in the presence of all incorrect choices.

Data consisted of the number of trials and number of minutes to reach an errorless trial.

The subject was given no set of instructions to verbalize the meanings of the classes. But after the subject had reached the criterion he was asked to state the meaning of each concept by defining the distinguishing characteristics of the classes.

III. Results and Conclusions

(1) There was a clear tendency to acquire the concepts in less time as the amount of reinforcement increased.

(2) Scores expressed in minutes were more sensitive in reflecting group differences than scores in trial frequencies.

(3) The claim that concept formation is qualitatively different from less "complex" learning was not supported. In fact, reinforcement, a quantitative variable, proved fruitful in showing significantly different functional relations among groups.

(4) When subjects were not given a set to verbalize class meanings they failed 75 per cent of the time to render adequate definitions of the acquired concepts.

Educational Implications

The significance of these conclusions to classroom learning, however, is frankly a matter of logical inference. We do not yet know what specific effects reinforcement schedules have on the grasp of

meaningful ideas in various classroom situations. But this study suggests together with what is already known that the teacher may do well to: (1) Be certain that the desired response is performed before assuming that learning has occurred, and (2) to reinforce the response profusely during initial acquisition. Also, the teacher may profit by noting the various responses that compose a skill, act, or other complex behavior. And instead of merely reinforcing the end result, he may find profit in rewarding the separate movements that make up the skill. This casts some doubt on the feasibility of accepting uncritically the dictum that only through the study of behavior as a "whole" learning can be understood and explained.

This study also suggests that research in educational psychology could benefit by borrowing more heavily from the results of the more rigidly controlled experiments in "simple" learning. For example, the works of Professor B. F. Skinner and Professor E. R. Guthrie seem particularly promising as the basis for constructing parallel studies in education.

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THE COMPARATIVE ACHIEVEMENT OF VETERANS ADMITTED TO INDIANA UNIVERSITY ON THE BASIS OF GENERAL EDUCATIONAL DEVELOPMENT TESTS AND A SELECTED GROUP OF OTHER INDIANA UNIVERSITY STUDENTS

(Publication No. 5859)

Louis Anthony D'Amico, Ph.D.
Indiana University, 1953

This study investigated the scholastic achievement of male veterans admitted to Indiana University on the basis of General Educational Development tests from February, 1946, through September, 1950, and compared their achievement with the achievement of a randomly selected group of other male students who were admitted to the University during the same period.

There were 478 GED students admitted to Indiana University from February, 1946, through September, 1950; 307 of whom attended the Bloomington campus, and 171 of whom attended the various extension centers. A study was made of the distribution of the means and the standard deviations of unweighted college credit point ratios of the 307 GED campus students in the experimental group and the 307 non-GED campus students in the control group. The associated variables used as bases for comparison were: intelligence quotient; state residence; town size; size of high school; time lapse since last school attendance; high school units taken; age; the division, college or school of the University in which enrolled, and type and number of degrees earned, if any. Statistical tests (F tests) to determine significant differences between means were applied.

Analyses were made of the relationships between the GED test standard scores and college credit point ratios for campus and extension center GED students. Correlations between the standard scores on the individual GED tests and the credit point ratios in the related college subject areas were obtained. The correlation between the average GED test battery standard scores of 423 GED students who took college courses in the subject areas related to the GED tests and the credit point ratios in the five related college subject areas was obtained. The correlation between the average GED test battery standard scores for 433 GED students and the credit point ratios in all subjects taken in college by the GED students was obtained. The significance of correlation (t tests) were computed to discover whether the sample showed relationship or correlation by chance or whether some correlation existed between the two variables involved.

Among the findings revealed by the data of the study were the following: (1) the achievement of the GED students who progressed beyond the freshman year compared favorably with the achievement of the non-GED students who progressed beyond the freshman year; (2) the average high school attendance of approximately 87 per cent of the GED group was slightly over two years as compared to the full four year high school attendance of the non-GED group (there was no record of high school attendance for approximately 13 per cent of the GED group); (3) the GED group attained 78 college degrees as compared to 91 college degrees attained by the non-GED group; (4) the GED and non-GED students who were 25 years of age and over earned the highest mean credit point ratios of their respective groups; (5) the coefficients of correlation found between the standard scores on each of the five GED tests and credit point ratios in each of the five related college subject areas ranged from .41 to .48; (6) the coefficient of correlation found between the average GED test battery standard scores and the credit point ratios in all college subjects was .53.

From the findings of the study the following conclusions are made: (1) the high school level GED test battery has been a good admissions instrument at Indiana University; (2) the critical average GED test standard score, dividing successful and unsuccessful achievement of students admitted to Indiana University on the basis of GED tests, was approximately 52.50; (3) coefficients of correlation found between the standard scores on the GED test battery and credit point ratios in college course were not of sufficient size to warrant their use for predictive purposes.

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A STUDY OF THE RELATIONSHIP OF THE SELF-CONCEPT TO ADJUSTMENT IN A SELECTED GROUP OF COLLEGE WOMEN

(Publication No. 5916)

Frances Helen DeLisle, Ph.D.
Michigan State College, 1953

The general purpose of the study was to investigate the relationship of the self-concept to adjustment among selected freshman women at Michigan State College. Specific purposes included the investigation of : (1) how individuals see themselves in relation to certain facts which are known about them; (2) how the same individuals are seen by their peers; (3) what changes in self-understanding occur; and (4) what the consequences for personal adjustment appear to be.

Two groups of thirty-five freshman women representing opposite ends of a continuum of academic achievement comprised the sample. At the upper end of the continuum scale were the thirty-five women who had been selected on the bases of scholarship, character and leadership as the prospective members of Tower Guard, the sophomore honorary organization for women. At the lower end of the achievement scale were thirty-five women who had been placed on scholastic probation due to an accumulation of a deficiency of twelve or more honor points during the first two terms of college.

The procedure for all subjects consisted of the following:

1. Administration of a Test of Self-Understanding as a preliminary instrument to determine the initial picture of the self.
2. Administration of a common battery of tests including: Social Personality Inventory for College Women, Self-Inventory of Personal-Social Relationships, and Kuder Preference Record — Vocational.
3. An interview with one of the four cooperating counselors for interpretation of the above tests and the A.C.E. Psychological Examination which had been previously administered.
4. Readministration of the Test of Self-Understanding for evidences of changes.
5. Distribution of an inventory to be completed and returned by two members of the peer group who knew the subject.

The test results and information from the inventories, college application blanks, grade sheets, and counselor records comprised the data which were compiled, tabulated, analyzed, and reported in the study.

The results of the research indicated that the higher achievement subjects tend: (1) to have a more realistic concept of self; (2) to demonstrate less tendency to minimize their difficulties and to distort their picture of the self; and (3) to utilize more fully the resources of the environment as a means of strengthening skills and overcoming difficulties.

In contrast, the lower achievement subjects tend: (1) to have a less realistic concept of the self; (2) to feel the need to deny or distort the perceptions which they interpret as damaging to the self; and (3) to experience more difficulty in utilizing environmental resources.

Both groups of subjects demonstrated a tendency to evaluate themselves more accurately than did their peers, and to change the picture of the self as a result of the opportunity for test interpretation.

Adequate personal adjustment appeared to be more promising for those subjects who were able to accept the perceptions of the self, to openly assess their weaknesses and limitations, and to utilize the resources of the environment as developmental aids.

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AN INVESTIGATION OF APPERCEPTIVE DISTORTION IN THE OBSESSIVE-COMPULSIVE CHARACTER STRUCTURE BY THREE METHODS, VERBAL DESCRIPTION, GRAPHIC-EMOTIONAL DRAWINGS AND GRAPHIC-GEOMETRIC DESIGNS WITH SPECIAL REFERENCE TO A DEFENSE MECHANISM, REACTION FORMATION

(Publication No. 5415)

Michael Herbert Paul Finn, Ph.D.
New York University, 1953

The Problem

This investigation was devoted to the purpose of studying apperceptive distortion in the obsessive-compulsive character structure by three methods of human expression. The three methods are Verbal Description, Graphic-Emotional Drawings and Graphic-Geometric Designs.

Methods and Procedures

The population consisted of ten obsessive-compulsive characters, the experimental group, and ten non-obsessive-compulsive characters, the control group, chosen from a college population by the Group and Individual Rorschach. All subjects placed within the prescribed 35th to the 99th percentile rank on the A.C.E. test.

The experimental materials consisted of the Graphic-Emotional Series, four twin pictures depicting ambiguous, loving-hating situations between mother and child; and the Graphic-Geometric Series, four distorted Bender-Gestalt designs.

The experimental procedure consisted of exposing the Graphic-Emotional Series for .5 second to each subject who then described the cards into a recorder. The Graphic-Emotional Series were again exposed for .5 second and the subjects drew what they had seen. The Graphic-Geometric Series were exposed for 5 seconds per design and the subjects drew what they had seen.

The graphic reproductions and recordings were then rated by two judges on the basis of whether the reproductions had been made positive or negative compared to the originals. A five point rating scale was employed.

The obsessive-compulsive and the non-obsessive-compulsive results were then compared to determine any differences in apperceptive distortion.

Results

In the obsessive-compulsive group, no significant differences were found to exist between the Verbal and Graphic-Emotional modes of expression. Significant differences were found to exist between the Graphic-Emotional and the Graphic-Geometric methods. Significant differences also existed between the Verbal and Graphic-Emotional methods. The order of apperceptive distortion occurred as follows, from the most positive to the least positive: Graphic-Geometric, Verbal Description and Graphic-Emotional.

In the non-obsessive-compulsive group, significant differences were found to exist between the Verbal and Graphic-Emotional methods and between the Graphic-Geometric and Graphic-Emotional methods. The differences between the Verbal and Graphic-Geometric methods were not significant. The order of apperceptive distortion occurred as follows, from the most positive to the most negative: Verbal Description, Graphic-Geometric and Graphic-Emotional. All apperceptive distortion was positive except Graphic-Emotional which was negatively distorted.

Between the two groups, there were no significant differences in Verbal Description. Significant differences did exist between the Graphic-Emotional and Graphic-Geometric methods. In all three methods, the obsessive-compulsive characters reproduced more positively than the non-obsessive-compulsive characters.

No definite relationship could be established between the apperceptive distortion in this study and the literature on reaction formation.

Conclusions

The following conclusions are tentative in nature due to the small samples and the difficulty of rating drawings and verbal productions equally well. The conclusions are delimited to a college population, ages 18 to 30 years with average to above average intelligence.

1. Obsessive-compulsive characters apperceptively distort visually perceived ambiguous situations in the following order:
   a. The most positive distortion: graphically reproducing distorted, geometric figures.
   b. The next most positive distortion: verbally reproducing ambivalent or amibguous human situations.
   c. The least positive distortion: graphically reproducing ambivalent or ambiguous situations.
2. There are significant differences in apperceptive distortion between the obsessive-compulsive and non-obsessive-compulsive characters, graphic-emotionally and graphic-geometrically, the obsessive-compulsive characters apperceptively distorting more positively.
3. Many defense mechanisms may be operative in a single situation or stressful situation at one time.
4. The findings suggest that obsessive-compulsive characters tend to minimize aggression and tend to improve or to make "better" a "bad" gestalt.
5. It could not be stated that the apperceptive distortion found in this study was definitely related to reaction formation.
6. The results of this investigation are merely suggestive and further research is necessary in the areas of apperceptive distortion and human defensive maneuvers with special reference to the experimental design of such research.

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SOME FACTORS INVOLVED IN LEARNING SHORTHAND — ANALYSIS OF THE LEARNING LOAD OF TWO SYSTEMS OF SHORTHAND

(Publication No. 5530)

Hazel Arnette Flood, Ph.D.
University of Minnesota, 1953

The purpose of this study was to make an inspectional analysis of the initial learning materials of two systems of shorthand to discover provisions for gradation, some of the factors that might make the materials unnecessarily difficult, and areas in which further investigation seems essential.

The problem of gradation was approached through an application of the Flesch Readability Formula, an analysis of the vocabulary and the ratio of new words, and an analysis of the principles covering the theories of the two systems and the distribution of the principles.

The problem of locating the difficult factors was approached through an analysis of the number of repetitions provided for the vocabularies and the principles covering the theories, and through a study of the consistency in the applications of the principles.

A significant contribution of this study was to locate areas in which further research seems essential.

Gradation. The RE scores of the materials of both systems was found to be between 70 and 80, indicating comparatively easy material so far as comprehension can be measured by the formula. The range of scores obtained by applying the formula to units and to chapters is from very easy through standard.

Both the length of the lessons and the ratio of new words appear to have been largely dependent on the segment of theory presented rather than on an analysis of the learning burden and generally accepted techniques of preparing reading materials.

Provided that principles are equally difficult to master, it would appear that there has been no attempt to give consideration to a combination of the principles in the gradation of the materials.

Factors Affecting Difficulty. The first lessons of both systems appear to be quite simple and there should be little difficulty in learning them unless the student has difficulty in thinking of the phonetic sounds of words rather than the longhand spelling.

Approximately 76 per cent of the words used in the materials in Chapter I of the Gregg system and 86 per cent of the words used in Unit I of the Thomas system are monosyllabic words. Approximately 96 per cent of the words used in the materials in Chapter I of the Gregg system and approximately 99 per cent of the words used in Unit I of the Thomas system do not have more than two syllables.

The criterion of ten repetitions per word was set up as a tentative measure of adequacy so far as automatization of the basic vocabulary is concerned. If this criterion may be accepted as a minimum, the Gregg materials provide for automatization of approximately 15 per cent of the total vocabulary; the Thomas materials, approximately 13 per cent. Approximately 56 per cent of the total Gregg vocabulary and 63 per cent of the total Thomas vocabulary has not appeared more than two times.

Twenty-two principles in the Gregg theory and nine principles in the Thomas theory appear to have limited applications. Mastery of the principles would not be possible without supplementary work designed to strengthen the weaknesses.

The many inconsistencies noted would tend to increase the memory burden unnecessarily and increase hesitancy and confusion in the writing of new words.

There is no experimental evidence on factors which make for difficulty in shorthand. Investigations paralleling research studies in readability might lead to a statistical formula which can be used in the preparation of new materials and in the evaluation of what is written for use in the public schools.

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MEMORY OF SUCCESS AND FAILURE IN A LEARNING SITUATION

(Publication No. 5796)

James Lee Gilmore, Ph.D.
Stanford University, 1953

The purpose of this study is to extend the investigation of the effect of threat in the learning situation. Experimentation in this field is of basic importance to education. The essence of the educational process is the cognitive experience of the child in the class room. An understanding of the influences which environmental factors, such as threat, may exert on this cognitive function, is naturally important to the educational psychologist.

This study is designed to measure experimentally the predictive potential of a theoretic construct concerning the influence of threat on cognitive function. This construct was formulated by Bruner and Postman in reference to one cognitive operation, perception. Here the construct is tested in an application to a second cognitive operation, memory.

The construct postulates three cognitive functions: "resonance," "defense," and "vigilance." "Resonance" is the supposed tendency for cognitive function to favor objects "valued or needed" by the individual in situations perceived as being of low personal threat. "Defense" is the tendency for cognitive function to exclude that which is mildly threatening, and "vigilance" is the tendency towards increased cognitive sensitivity for those objects which are believed to hold a serious threat for the individual. Some of the experimental work of Rosenzweig, Alper, and Glixman was cited to suggest the predictive utility of the construct.

Experimental hypotheses were stated concerning the memory of successfully completed and failed tasks as a function of stress interpretation. It was postulated that subjects indicating a low stress interpretation of the experimental situation would be "resonant" in their recall, those indicating a moderate stress interpretation would be "defensive" in their recall, and those indicating considerable stress in their interpretation would be "vigilant" in their recall.

A test instrument, consisting of ten successful and ten failed tasks, was administered to 444 college students enrolled in general psychology courses. Procedures were followed which yielded data on students' immediate and delayed recalls of the successful and failed tasks, and subjects' judgments of the affective nature of the test situation. This experimental procedure provided data for the testing of the hypotheses.

Only the predictions based upon the function of "defense" found full support in the experimental results. Subjects who indicated a moderately stressful interpretation of the experimental situation "defensively" recalled significantly more successful than failed tasks. This tendency became more marked with the passage of time.

The hypothesis which predicted a "resonant" memory preference for successful tasks by low stress interpretation subjects in delayed recall found significant support in the results. It was predicted that the "resonant" cognitive function of these subjects would result in a favored memory for failed tasks in immediate recall. This did not happen. This so called "Zeigarnik Effect" seems to occur only as long as subjects are engaged in solving the tasks. Since the task booklets were collected before the immediate recall was administered, perhaps the "Zeigarnik Effect" had been dissipated.

The hypotheses based upon "vigilant" function found no support in the experimental results. If there is such a thing as "vigilant" function it would seem that a more extreme perceived threat is necessary for its production.

There are two general trends in the experimental results which seem worthy of comment. The first is the significant over-all tendency for success to be favored in recall. In general this trend becomes more marked with the passage of time.

The second trend is found in the immediate recall results. Here the recall preference for successful tasks becomes more marked as subjects' stress interpretation increases.

Possible implications of these findings for educational theory and practice were discussed.

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SOME EFFECTS OF POWER ON THE RELATIONS AMONG GROUP MEMBERS

(Publication No. 5682)

Jacob Isaac Hurwitz, Ph.D.
University of Michigan, 1953

The purpose of this study is to uncover some of the effects on interpersonal relations and group functioning of differences in prestige and social power among members of informal, face-to-face discussion groups.

The major theoretical conception advanced is that group members having relatively little power to influence others will perceive and behave towards members high in social power in an essentially defensive manner, i.e., in ways calculated to reduce the feelings of uneasiness experienced in their relations with the Highs. Thus, for example, due to this uneasiness, Lows will tend to like Highs, to overrate the extent to which Highs like them, to distort the initial opinions of Highs in the direction of their own initial opinions, to communicate infrequently and, when they do talk, to talk mainly to Highs. Individuals high in social power will utilize these same anxiety-reducing mechanisms, but to a lesser extent than the Lows.

To test these assumptions, a one-day conference was organized in a mid-western city attended by 42 persons working in the field of mental hygiene. These individuals met each with four different groups to discuss four topics related to mental health and to provide the necessary measures. During the discussions, observers kept records of frequency and length of remarks as objective measures of participation.

With the exception of the opinion data, the results support the assumptions.

An ad hoc interpretation is advanced to account for the data on perception of extent of participation by others. It is that awareness by people of the restraints on Lows against communicating in social situations involving individuals of unequal status and of their being liked relatively less by other group members may engender expectations that Lows should participate relatively little in such group situations. Consequently, when Lows speak up, it becomes conspicuous and the extent of their participation is exaggerated.

Since variations in degree of social power among discussion group members apparently result in inability to judge accurately extent of being liked by others as well as extent of their participation, the question is raised as to the possibility of mutual understanding and satisfying relations among group members of unequal social power. Furthermore, these defensive reactions probably serve to increase preoccupation with problems of interpersonal relations at the expense of task-oriented activity. This means, of course, that the productivity of the individuals concerned and of the group as a whole may be reduced.

Microfilm copy of complete manuscript of 60 pages, $1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1360.

THE DEVELOPMENT OF DEMOCRATIC CONTROL IN JAPANESE EDUCATION: A STUDY OF ATTITUDE CHANGE IN SHIKOKU, 1948–1949

(Publication No. 5686)

Frederick Nichols Kerlinger, Ph.D.
University of Michigan, 1953

The main objective of this study is to demonstrate that a change from authoritarianism to democracy has taken place in Japanese education and attitudes during the Allied Occupation of Japan. To reach this objective, Japanese educational administration and ideology, together with the attitudes of educators and the people toward education before and during the Occupation are examined for evidence of change. The underlying hypotheses of the study are tested by examining the educational changes that occurred in one area of Japan, Shikoku, during one period, October, 1948, to November, 1949, to determine the extent and depth of Occupation influence.

The foundations of pre-Occupation Japanese education and attitudes pertinent to education were laid in the latter part of the nineteenth century, and were influenced to a considerable extent by foreign ideas. After 1890, however, Japanese education emphasized traditional Japanese virtues and values, and educational practices and thinking were quite commensurate with Japanese hierarchical, authoritarian society. In short, the educational system emphasized loyalty to the Emperor and the submission of the individual to the state. Over the years these characteristics became exaggerated until, just before and during World War II, they reached their greatest depth and intensity.

During 1945 and 1946, the Occupation Forces first negated the most objectionable features of the educational system, and then stimulated the construction of a democratic system the basic determination of whose policy would be the people of Japan. The apex and epitome of Occupation reforms in education are seen in the election of local boards of education in October, 1948, and the actions and operations of the four prefectural boards of Shikoku during their first year are examined for signs of democracy and changed attitudes. Several criteria for judging democracy in education are given, and the Shikoku educational situation is studied in the light of these criteria. It is found that the four boards of Shikoku met their difficulties and solved their problems in a relatively independent and responsible manner, and their decisions and

actions helped to strengthen educational democracy in Shikoku. Teachers and the people showed interest in and supported the boards, and they also participated in educational affairs to an extent unknown and impossible under the old system.

Positive and negative influences on educational democracy in Shikoku are discussed, and it is concluded that the positive influences outweighed the negative. Of these positive influences, perhaps the most important was the atmosphere of freedom that existed in Shikoku during the latter part of the Occupation. Judging from the behavioral evidence presented, there seemed to be a marked predisposition to accept the reforms and the new education.

The conclusions drawn are that, during the Occupation, there was a change from authoritarianism to democracy in Shikoku education and attitudes — and Japanese education and attitudes — that, other things being equal, the prospects for continued educational democracy, in Shikoku and in Japan, are good, and that it is doubtful if Japan can ever return to the former unilateral hierarchical authoritarianism of its earlier educational system.

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A COMPARISON OF THE SCHOOL RECORDS OF DELINQUENT AND NON-DELINQUENT BOYS

(Publication No. 5687)

Mead Wilbur Killion, Ed.D.
University of Michigan, 1953

Statement of the Problem

The purpose of this study was to determine, by comparing the school records of a group of delinquent boys with the school records of a comparable group of boys who were not delinquent, if the delinquents would show patterns of personal characteristics, achievement, behavior, and treatment, which would be significantly different from those of the non-delinquents.

Procedure

The names of seventy-eight boys were selected from the files of the Youth Bureau of the Detroit Police Department, from the total list of fifteen-year-old repeated offenders of the year 1951. A control group of seventy-eight non-delinquent boys was selected by a sampling procedure. The experimental and control groups were matched on the bases of age, school setting and social setting. The school records of both groups, including standard report forms, reports from counselors, and clinical reports, were the sources from which frequency data were derived. From the frequencies, percentage and contingency tables were composed showing the differences between the groups with regard to more than fifty items of information. The chi-squares of the differences were used to test this major hypothesis: The educational experiences of delinquent youth have been significantly different in some respects from the educational experiences of non-delinquent youth.

Results

The delinquents were found to be significantly different from the non-delinquents in the following respects:

1. personality characteristics
2. mental health
3. achievement in both elementary and secondary school
4. behavior in both elementary and secondary school
5. referral by school staff to agencies and resource persons

They were found to be different, but with questionable level of significance, in the following respects:

1. physical characteristics
2. mental rating
3. participation in extra-class activities

Conclusion

The evidences from the study of the school records of a group of seventy-eight delinquent boys and a comparable group of non-delinquent boys, derived from more than fifty items of information, support the view that there are significant differences between the experiences of delinquents and non-delinquents in school.

Microfilm copy of complete manuscript of 157 pages, $1.96. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1362.

THE EFFECTS OF PHOTOGRAPHIC CLARITY ON THE CHOICE OF SZONDI PICTURES

(Publication No. 5423)

Marvin Metsky, Ph.D.
New York University, 1953

The purpose of the investigation was to determine the effects of photographic clarity on subject preference for the Szondi pictures. The specific problems arising out of this major consideration revolved around (1) whether there were differences in degrees of photographic clarity between the pictures comprising the Szondi test, (2) whether patterns of choice reactions remained the same under control and experimental conditions, and (3) whether a relationship existed between subject choice of pictures and the degree of photographic clarity inherent in the picture.

Twenty five photographers were enlisted to act as judges. Using a rating scale as a guide each series of pictures, considered as a separate entity, was rated from highest to lowest in clarity. Upon completion of the judging process the mean rating of all the cards in each series was computed. A retouching photographer then devised an experimental Szondi set in which the clarity of each series of pictures, considered separately, was lowered to approximate that of the card or cards originally rated least clear in the

series under consideration. With the completion of the experimental set, each photographer was revisited to obtain a second set of judgements in order to ascertain the degree of approximation that had taken place.

Four hundred male college students, closely matched for age and class status, comprised the testing population. One group of two hundred subjects, the control section, was administered the regular Szondi set of pictures. The other group, the experimental section, was shown the altered set of photographs. Each subject was administered the complete set, one series at a time, and requested to select cards in order of preference from most liked to least liked.

The two groups were compared for significant statistical differences, using t-score computations, with respect to (1) the proportion of time each card was ranked in the upper half of the series, and (2) the median of subjects who ranked it on a card for card basis. A sign test, to explore directional choice reactions, was applied; sigma scores, obtained from the calculation of median differences, were compared for each card in order to ascertain differences in variability under the two conditions; and rank difference correlation coefficients were computed to determine the relationship between subject choice of cards and photographic clarity under the two conditions.

The judges' ratings demonstrated that measurable, frequently pronounced differences in photographic clarity exists among the pictures comprising each series of the regular Szondi test.

The statistical findings indicated that the lack of uniform clarity in the regular Szondi photographs exerted an influence, beyond reasonable chance expectancy, on the choice reactions of subjects.

This influence, however, did not appear to markedly affect subject preference for the pictures, and apparently did not exert any significant change on the resultant total picture.

Furthermore, the influence of clarity did not take any consistent direction, but appeared to depend on the individual picture. Some were apparently chosen, to a statistically significant degree, because of greater clarity while others were chosen because of their relative vagueness.

The results appeared to suggest a fairly reliable relationship between greater subject preference for higher clarity cards and lesser preference for lower clarity cards. This finding was not consistent through all series of the test, however, and therefore could not be generalized.

The findings additionally suggested that aside from the elements of photographic clarity other factors peculiar to the photographs themselves, and not previously considered, play an influential role in influencing subject reaction to the pictures.

Although the element of photographic clarity did not appear to bear any strong influence, it did exist as a significant factor affecting choice reaction to the test. It was therefore indicated that any fully valid rationale for the test must take this into consideration.

Microfilm copy of complete manuscript of 200 pages, $2.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1363.

SIBLING RESEMBLANCES IN ACHIEVEMENT

(Publication No. 5726)

Sarah Katherine Morehart Schoonover, Ph.D.
University of Michigan, 1953

The purposes of this study were (1) to determine to what extent siblings resembled each other in educational achievement and (2) to discover to what extent differences between siblings were reduced when compared to unrelated pairs within the same population.

All true sibling pairs, who attended the University of Michigan Elementary School, who had chronological age overlap, and who took the Stanford Achievement Test four or more times per sib, from the Fall of 1929 up to the Spring of 1951, were used in this longitudinal study.

Growth graphs were constructed for the members of each family, for each of the following achievement measures: arithmetic, education, language, literature, reading, science, social studies, and spelling. Chronological and achievement ages were plotted on the abscissas and on the ordinates of the graphs, respectively. The linear best fit for each child for each of the achievement measures was found mathematically and was plotted graphically. (These sibling achievement graphs, as well as the detailed measurements used in the calculations, are included in the Appendix.)

Achievement ages of each pair of siblings were read at the mid-points of their chronological age overlap, from the linear best fit. The differences between these two achievement ages gave the average difference for each sibling pair. The sum of these average differences was divided by the number of pairs to obtain the means of the average differences for the siblings.

To secure comparable data for unrelated pairs, siblings of this study were paired randomly with a non-related partner, and the means of the average differences were calculated for the unrelated pairs. Ratios were computed by using the means of the average differences of the sib-pairs as dividends and those of the corresponding unrelated pairs as divisors. A "t" test for significance of the differences between sib and unrelated pair means was used.

In addition to the ratio of the means, correlation coefficients were computed for the sibling pairs, and a "t" test of significance was employed.

According to the results, the average variation of the eight achievement measures for the total group of siblings was 31.4 per cent less than that for the unrelated pairs. Except for science all differences between sib pair means and unrelated pair means were significant.

Correlations for the total sibling group ranged from .39 to .64, and averaged .495 for the eight

achievement measures. All sibling correlations were significant.

The three methods of analysis utilized on the growth records in this study (means of the average differences, percentage reduction of differences by family membership, and correlation), as well as the inspection of the growth curves for pattern similarities such as flexion points, plateaus, and spurts, produced consistent results in describing the existence of a substantial amount of sibling resemblance in school achievement.

Microfilm copy of complete manuscript of 440 pages, $5.50. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1364.

THE EFFECT OF DIRECTION AND NONDIRECTION ON CHILDREN'S DRAWINGS

(Publication No. 5742)

Stanley Robert Sprung, Ph.D.
University of Michigan, 1953

This study investigates the production of psychological distress symbols in children's drawings under different directional circumstances. The experimental situations are: nondirection, strong direction, mild direction, and intermediate direction. This order is used to obtain contrast between direction and nondirection in variable orders of magnitude.

Identical material for the production of the drawing was distributed to each of 109 children enrolled in the Elementary School of the University of Michigan, and instructions were given. The drawings were collected and evaluated in order to locate symbols interpreted to be positive or negative indicators of psychological distress.

Three hypotheses were tested and established.

1. Nondirection provides for sex differences related to distress or nondistress.
2. Nondirection provides for increases in the amount of distress due to aging — and, by implication, growing.
3. Direction provides for increases in distress in contrast to nondirection.

Two additional hypotheses were tested but not established.

4. Direction provides for reductions in distress due to aging — and, by implication, growing.
5. Direction provides for distress symbols in proportion to its intensity.

The Chi Square Goodness of Fit Test was systematically applied to all of the symbols secured from the drawings. Those associations attaining statistical significance at the level P = 0.05, or less, were given interpretation. Those results which gave P at a greater magnitude than 0.05 were excluded from text and placed in the appendix.

The results warrant the formulation of five conclusions. First, girls are making better adjustmental efforts than boys of similar chronological age. Secondly, as a child grows older he evidences more distress because of much ambivalence due to greater integration and recognition of the confusion which exists between social expectations and self-desires. The third conclusion states that direction in general provides for more distress than does nondirection. Freedom of activity, therefore, should be extended to children. The next conclusion indicates that direction has little influence upon the production or dissolution of distress as a child grows. Finally, the amount and kind of direction has no effect on the production of distress symbols. This suggests that a small amount of direction may be as controlling, from the child's viewpoint, as excessive direction — or even as punitiveness. In other words, it is not intensity that gives affect to the child, but the presence of direction. Removal of directive pressure, then, is suggested as a technique to reduce psychological distress.

Microfilm copy of complete manuscript of 213 pages, $2.66. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1365.

EDUCATION, TEACHER TRAINING

A DIAGNOSTIC AND PROGNOSTIC ANALYSIS OF SELECTED FACTORS IN TEACHER TRAINING AT THE UNIVERSITY OF WASHINGTON

(Publication No. 5890)

Harriett Virginia Batie, Ph.D.
University of Washington, 1953

The purposes of this study were: (1) to contribute data which would aid in diagnosing some of the factors which merit study and analysis in teacher training at the University of Washington and, (2) to offer conclusions and recommendations for future planning as implied by these data.

The data were collected by means of a questionnaire which was sent to all persons who received a certificate through or were recommended for certification by the University of Washington from October 1946 through August 1950. Since 564 of the 880 certified persons responded, with 68 of the questionnaires returned unclaimed, it is suggested that this was a fair sampling. However, in the absence of evidence that this was an unbiased sampling of the total number, conclusions and recommendations were limited to the data received from the respondents.

To organize and simplify the data, they were analyzed under three headings, namely: (1) Personal and professional data as contributed by the 564 teacher and non-teacher respondents, (2) Suggestions offered by the 436 teacher respondents with reference to teacher training, and, (3) Professional areas which the teacher respondents found to be most difficult.

Several of the more interesting findings may be summarized as follows:

1. There were 296 men and 268 women respondents including 128 non-teacher respondents (65 men and 63 women) and 436 teacher respondents (231 men and 205 women).

2. The age range of the respondents was from 20 to 65 years with more women than men at both extremes.

3. Nearly 90 per cent of all respondents had remained in Washington State, including 69.5 per cent of the non-teacher respondents and 95.4 per cent of the teacher respondents.

4. Of the total respondents, 82.2 per cent of the men and 4.1 per cent of the women had served in the Armed Forces.

5. Approximately 35 per cent of the respondents had decided to teach before they entered college.

6. The cumulative grade average as reported by all respondents averaged slightly higher (B+) than did the average for the non-teacher respondents.

7. Of the total respondents, 83.2 per cent had acquired a bachelor's degree and 14.4 per cent had completed advanced degrees.

8. A total of 77.3 per cent of all respondents were teaching. Of the non-teacher respondents, 38.3 per cent (8.7 per cent of total respondents) had never taught.

9. Of the teacher respondents, 55.0 per cent spent 30 hours or less per week in the classroom, while 7.3 per cent spent approximately 40 hours there.

10. Of the teacher respondents, 45.9 per cent spent 0-5 hours per week in school-community activities with 6.4 per cent spending more than 20 hours in this manner.

11. Several men teacher respondents moved into administrative positions early in their professional careers.

12. The majority of the elementary teachers were employed in self-contained rooms and only 8.8 per cent of them were teaching on a shift basis in May, 1951.

13. Of all secondary teacher respondents, 26.0 per cent were teaching one subject.

14. Of the teacher respondents, 37.8 per cent supplemented their teaching income by working at an additional job from two weeks to all year round.

15. Teacher respondents suggested that more opportunities for observation, with longer periods of directed teaching and more practical techniques and applications of principles and "theories" as presented in the teacher training and subject matter classes would have been helpful in their training program.

16. Professional difficulties as checked by teacher respondents, in the order of their frequency, were: meeting individual differences in large classes, planning for and working with individual problem children, motivating pupil learning, evaluating students' progress, budgeting of time, adjusting to deficiencies in school equipment, discipline and pupil control, keeping records and making reports, and techniques to improve student learning. Relationships between certain groupings of teacher respondents and these areas of difficulty were studied.

Microfilm copy of complete manuscript of 306 pages, $3.83. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1366.

ACCREDITATION SCHEDULES AND PROCEDURES FOR TEACHER EDUCATION

(Publication No. 5770)

John Leatham Marks, Ed.D.
Stanford University, 1953

In 1951, the Joint Committee on Accreditation of the California Council on Teacher Education and the Western College Association was appointed to study the policies and practices of the accreditation of California colleges and universities. This group first undertook to discover ways and means of improving accreditation and evaluation standards applied by the Accreditation Committee of the State Board of Education and the Committee on Membership and Standards of the Western College Association. Integration of the accrediting visits was facilitated by the outlining of common and joint practices which were adopted by the two organizations. Effective collaboration in evaluation of college programs depended on the development of a statement of common criteria and a definition of common reporting procedures; this was the task undertaken by the Joint Committee.

Purpose of the Study

To appraise the effectiveness of the accreditation schedules and procedures (developed by the Joint Committee) in promoting the two functions of accreditation: establishing minimum standards for, and up-grading of, the programs of higher education.

Procedures

The final evaluation of the schedules and procedures was performed during the formal accreditation of two institutions. Appraisals by the staff and the visiting committee at each college were obtained by four detailed questionnaires. One was completed by each group after the written report had been prepared and distributed; they each responded again after the visit. Replies were supplemented and verified by interviews during the visitation at one of the institutions.

Conclusions

1. Functional Effectiveness of the Schedules: The maintenance of minimum standards was accomplished by collecting complete reliable data, by appraising crucial aspects of programs, and by evaluation in terms of purposes. The self-study feature was effected by focusing attention on objectives, stimulating faculty discussion, and collecting data on which program revision could be based.

2. Practicability of Procedures: An analysis of the accreditation report established that the college staff was selective in designating the functions of its programs and was also objective in appraising

limitations. Responsibility for the accreditation report was spread among more faculty members, and the preparation of the report was encouraged as a committee project.

3. Economy of Time and Effort: The written report, based on the new procedures, was definitely longer than in previous accreditations. Counteracting this factor of increased size were these factors: the material was extensive but not overly so since the comprehensiveness insured the self-study feature; the data were complete and worth collecting.

On the basis of the types of evidence described, the faculties of both schools and both visiting committees recommended that the self-study feature be continued as an integral part of accreditation procedures, after appropriate revisions of the schedules. The conclusion that the college staff members having originally asked for the self-study feature and having tried it out, still wanted it, seemed warranted.

Recommendations for Additional Research

1. Continued revision of the instruments is essential. Provisions for increasing their convenience, refining procedures, and including new evaluation techniques are necessary.

The greatest improvement in accrediting procedures should come from the more effective use of the forms and procedures as they contribute to the upgrading of collegiate programs. Suggested means of accomplishing this are:

1. Developing plans for maintaining self-study interest between accreditation by means of interchange of faculty members and by discussion meetings (of the California Council on Teacher Education and the Western College Association) devoted to reporting successful self-study projects.

2. Developing programs for aiding the college staff as it begins the accreditation period.

3. Developing procedures for preparing a more concise yet well organized report.

4. Exploring by the faculty for new sources of evidence on which to base evaluation.

5. Investigating adjustments, if any, in the procedures required for using the schedules in a diversity of kinds and sizes of institutions.

The present investigation has established the value of the experimental procedures for the dual purposes of maintenance of minimal standards and stimulation of self-study, to their mutual advantage. The problem from here on is to find more effective and creative means for both purposes.

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RECOMMENDATIONS REGARDING CONCEPT CONTENT AND LEVEL OF TREATMENT IN SELECTED AREAS OF THE UNDERGRADUATE PROFESSIONAL EDUCATION CURRICULUM FOR SECONDARY SCHOOL TEACHERS IN MINNESOTA

(Publication No. 5553)

Glaydon Donaldson Robbins, Ph.D.
University of Minnesota, 1953

Since 1950 certain agencies in positions of influence over teacher education programs in the State of Minnesota have tended to classify the content of the professional education aspect of those programs into four or more broad areas. Two of these broad areas to which reference is commonly found are Growth and Development, and Orientation to Teaching. The purpose of this study was to determine: (1) which concepts should be included in the content of each of these two areas, and (2) what level of treatment should be accorded to those concepts within the indicated areas.

From sources commonly used in professional courses including textbooks, courses of study, syllabi, and professional education workshop reports, a total of 131 major concepts were synthesized. Illustrated by 587 minor component concepts, the 131 concepts were incorporated into a check list which provided alternatives of placing each of the concepts in either, both, or neither of the two areas and also the alternatives of indicating one of four recommended levels of treatment: (1) cursory reference, (2) brief summary, (3) comprehensive overview, (4) exhaustive exposition, for each concepts placed in either or both areas. The check list was submitted to a panel made up of the 21 individuals responsible for the administration and direction of the undergraduate professional education curriculum in each of the 21 institutions of higher education in Minnesota preparing secondary school teachers.

All panel members responded on the first administration of the check list and the reliability of responses, as determined by a second administration of the check list eighteen months later, was determined to be: $r = .885$ for placement of concepts in Growth and Development; $r = .726$ for placement of concepts in Orientation to Teaching; $r = .712$ for level of treatment recommendations.

Conclusions of this study based upon responses of the 21 panel members are: (1) the 36 concepts recommended for placement in the area of Growth and Development by a majority of the panel and the recommended level of treatment for each; (2) the 85 concepts recommended for placement in the area of Orientation to Teaching by a majority of the panel and the recommended level of treatment for each; (3) the 10 concepts which were not recommended for inclusion in either of the two areas by a majority of the panel; (4) the mean level of treatment (3.17) recommended for the 36 concepts placed in Growth and Development to be higher than the mean level of treatment (2.57) recommended for the 85 concepts placed in the area of Orientation to Teaching; (5) basic content for

Growth and Development includes, for example, the individual and aspects of his physical, mental, social, emotional, and moral growth and development; basic generalizations regarding states of growth and development, basic human needs, developmental tasks, and the factors influencing growth and development; the principles of learning psychology; factors influencing learning; (6) basic content for Orientation to Teaching includes, for example, the background of the American public educational system including its structure, organization, and administration; philosophy of education; historical and sociological foundations of education; methods and procedures in teaching; the curriculum; education in the State of Minnesota.

The findings of the study are indicated to be the pooled judgments of the respondents and are not to be accepted as absolute generalizations which could be applied in professional education curriculum development in any institution without careful analysis and adaptation. Additional research regarding the relationship between the content of the professional education curriculum and ultimate teaching effectiveness is recommended.

Microfilm copy of complete manuscript of 208 pages, $2.60. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1368.

TRAINING RURAL ELEMENTARY TEACHERS: A STUDY TO DETERMINE THE OPINIONS AND PRACTICES OF THE TEACHERS WHO HAVE EXPERIENCED THE PROGRAM FOR TRAINING RURAL ELEMENTARY TEACHERS AT WEST GEORGIA COLLEGE, CARROLLTON, GEORGIA, WITH IMPLICATIONS FOR THE IMPROVEMENT OF THAT PROGRAM

(Publication No. 5438)

William Hamilton Row, Ed.D.
New York University, 1953

The Problem

This is a study to determine the opinions and practices of the teachers who have experienced the program for training rural elementary teachers at West Georgia College, Carrollton, Georgia, with implications for the improvement of that program.

West Georgia College is a junior college unit in the University System of Georgia. In addition to the traditional junior college functions, it has also been assigned the specific task of training rural elementary teachers. For this purpose it offers the first two years of college work in general education plus a third year in professional education.

The study is limited to the 144 three-year graduates from 1941 to 1949 and to the 401 summer workshop participants for the same period. The employers of these students have also been contacted to determine their opinions of the practices and procedures of these students as they see them.

Questionnaires were received from seventy-seven per cent of the three-year graduates, from sixty-five per cent of their employers, from seventy-four per cent of the workshop participants, and from fifty-nine per cent of their employers. Personal interviews were conducted with a random sampling of fifty three-year graduates and their employers and of fifty workshop participants and their employers.

Major Conclusions

1. A good majority of these students have accepted positions in Georgia rural elementary schools and have remained in these positions.
2. The graduates feel that the following required courses were of the least value to them: introduction to education, biology, nature study, physical education, social science, humanities, mathematics, dramatics, and physical science.
3. The teacher-training program is related to teaching situations to a satisfactory or greater extent.
4. Extra-curricular activities of the graduates while in college consisted mostly of laboratory-school activities and campus clubs.
5. These teachers are obtaining less than satisfactory results in teaching social studies, music, art, and elementary science.
6. Most of the teaching aids are being used by a good majority of these teachers as well as the educational practices that were emphasized in their training.
7. These teachers are doing a good job of improving the physical set-up of their schoolrooms and schools and are participating in the life of their communities.
8. A high percentage are members of professional and honorary organizations.
9. The employers feel that these teachers have shown good or excellent professional growth and rank them as good or excellent teachers.
10. A good majority of them are of the opinion that the improvement of their teaching is due to their training at West Georgia College but that professional reading and supervision are also important factors.
11. These teachers feel that the major weakness of the program is the lack of the fourth year.
12. A majority of the workshop participants feel that they obtained good or satisfactory solutions for their problems.

Major Recommendations

1. In future faculty study programs emphasis should be placed on the value to the students of the courses in which they are enrolled. Faculty members should also visit the laboratory school to observe their students in practice as a means of becoming more conscious of this factor.
2. Effort should be made to guide teacher-training students into a variety of extra-curricular activities.
3. More emphasis should be placed on the teaching of social studies, music, art, and elementary science. If possible, it is desirable that additional courses be offered in these areas.
4. Effort should be made through county supervisors, principals, and superintendents to help teachers become more aware of their real problems as preparation for enrolling in the workshops.

5. A fourth year is needed to complete this teacher-training program.

Microfilm copy of complete manuscript of 209 pages, $2.61. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1369.

THE PROGRAM AND SUPERVISION OF ELEMENTARY STUDENT TEACHING IN THREE MID-WESTERN TEACHER EDUCATING INSTITUTIONS AND THEIR IMPLICATIONS FOR TEACHER EDUCATION IN THE PHILIPPINES

(Publication No. 5367)

Soledad Espejo Samonte, Ph.D.
University of Minnesota, 1953

The purpose of this investigation was to gather ideas about the program and supervision of elementary student teaching in the Iowa State Teachers College, the Wisconsin State College in Milwaukee, and the Illinois State Normal University which may be adapted in the Philippines. Interest in this research was prompted by the desire to contribute to the effectiveness of the new four-year elementary teacher education program in the Philippines. Beginning in 1954, the minimum qualification for elementary teaching in the Philippines will be graduation from a four-year elementary teaching curriculum above the secondary level.

The three Mid-western institutions visited are not random samples of American institutions. They were selected because they are old institutions and are often mentioned in the significant volume, School and Community Laboratory Experiences in Teacher Education. They are also near Minnesota where the writer pursued her graduate studies. The enrollment in each of these institutions approximates that of the Philippine Normal College, where she teaches.

The methods used in collecting data for this research were direct observation without instrumental control, unstructured interview, and references to written materials.

Background for this research was: (1) the writer's experience as an elementary classroom teacher, elementary school principal, and instructor of professional courses in teachers colleges in the Philippines; (2) courses in supervision of student teaching, professional education of teachers, and a workshop in teacher education at the University of Minnesota; and (3) a review of twenty doctoral dissertations covering student teaching and related activities. These dissertations were accepted by American universities from 1940 to 1951. Books and periodicals related to student teaching published after 1943 were also reviewed.

The following major findings of this research, may possibly be adapted in Phillipine teacher-educating institutions:

(1) The three institutions visited are members of the North Central Association of Colleges and Secondary Schools, and the American Association of Colleges for Teacher Education. The Philippine institutions preparing teachers should also consider forming a voluntary organization to raise their standards of teacher education.

(2) Suggestions are offered to improve teacher education in the Philippines by various methods. Examples are:

a. Cooperative determination of the competencies desired in today's elementary teachers.

b. Operational definition of the desired competencies to facilitate their achievement and evaluation.

c. Provision for courses to educate workers in teacher education, with special reference to those engaged in supervising student teaching.

d. Tuition-free courses for cooperating teachers.

e. Institutes, workshops, seminars, conferences, and committee work to promote the in-service education of faculty members and administrators.

f. Cooperative determination of the objectives of student teaching, and the responsibilities of student teaching supervisory personnel.

g. Publication of professional teachers' magazines at cost.

h. Stimulation and guidance of teacher education research.

i. Development of a handbook for student teachers.

j. The need for cumulative records, including their use in placing students in a student teaching situation in which he has opportunity for maximum development.

k. The guidance of student teachers through seminars, course work, conferences, and written guides.

l. The use of various techniques in evaluating student teachers' growth and development.

(3) The inclusion of nursery and kindergarten classes in laboratory schools.

(4) Evaluation of student teaching supervision and course work by college students.

(5) A course in public relations for schools.

(6) Maintaining good human relations among student teachers, supervisors, and coordinators.

The final chapter contains a brief historical sketch of the Philippines, and the present trends in elementary teacher education.

Microfilm copy of complete manuscript of 471 pages, $5.89. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1370.

EDUCATION, THEORY AND PRACTICE

A STUDY OF TWO METHODS OF TEACHING HIGHER DECADE ADDITION

(Publication No. 5454)

Aldon McKee Bebb, Ph.D.
State University of Iowa, 1953

The present investigation was designed to study the learning and retention of higher decade addition requiring bridging taught to pupils by two different methods. The study was divided into three parts.

Part one consisted of the use of the teaching and testing materials in the classrooms by the classroom teachers in all cases except in five where the writer did the teaching. One group of third grade children was taught to do higher decade addition requiring bridging by a method called "adding by endings" and was designated the Control Group. The other group was taught this process by a method called "adding by tens" and was designated the Experimental Group.

The sample consisted of 20 third grade classes in all randomly assigned with 11 in the Experimental Group and 9 in the Control Group. Usable data were obtained for 443 pupils, 253 in the Experimental Group and 190 in the Control Group. Sixteen teachers were involved in directing this part of the study.

A one-hundred item test was used as a criterion test to determine the facility of the two groups before any instruction was administered. Following five instructional lessons in each method for each group this same test, except for change in appearance, was given over to the two groups to determine the amount of improvement made by each group and consequently show the effectiveness of the two methods. Two weeks later the test was given again to see if there was any difference in retention between the two groups of the two methods studied.

Part two of this study was an effort to study children's thought processes in higher decade addition by having them add mentally and tell enough of how they added certain combinations to determine what method they were using. This was done by means of an interview technique with 33 cases in the Experimental Group and 41 cases in the Control Group.

Part three consisted of an evaluation of the two series of lessons used in part one and an evaluation of the current program of instruction in higher decade addition in the public schools. This evaluation was made by use of eleven questions to guide the teachers in their thinking. Twenty-nine teachers were involved.

The data appear to justify the following conclusions, subject to the conditions of the investigation:

1. There was no significant mean difference found between the two groups when the results of the Test II were analyzed with respect to immediate improvement. The slight difference of 1.71 in the means in favor of the Control Group suggests that the control method seemed somewhat superior.
2. Likewise, there was no significant difference found between the two groups on Test III for retention. The difference of 4.72 in favor of the Control Group does indicate this group continued to make a rather marked improvement during the two week retention period. This supports the conclusion that since the control method was the typical classroom method, it had much more possibility of being used during this period than the experimental method.
3. The control method seemed to be most effective when the lowest twenty-five per cent of each group was considered.
4. There was a significant gain made by each group from Test I to Test II at the one per cent level of confidence. This indicates that both methods were approximately equally effective.
5. The results of the interview technique seemed to favor the experimental method. More of the experimental cases used the method by which they were taught, used what is classed as an efficient method, used counting less, rated higher in proficiency, and were more accurate.
6. The teacher evaluations of the lessons and the study as a whole indicated that some of both types of lessons should be included in textbooks or somehow made available for instructional purposes.
7. The teachers, in general, indicated that there should be more definite instruction in higher decade addition in our current program of instruction.

Microfilm copy of complete manuscript of 252 pages, $3.15. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1371.

AN EVALUATION OF HANDWRITING IN CERTAIN IOWA SCHOOLS

(Publication No. 5461)

Sidney John Covert, Ph.D.
State University of Iowa, 1953

The purpose of this study was to evaluate the handwriting of sixth, ninth, and twelfth grade pupils in certain selected Iowa school systems.

The investigation was planned to reveal the quality of the usual handwriting of the pupils in these grades as well as the quality and speed of their handwriting produced under test conditions. Over eighteen thousand samples were collected from approximately 90 elementary schools, 34 junior high schools, and 33 senior high schools which were a part of 32 school systems. From this number approximately one thousand specimens each of the test and usual handwriting samples of each grade were randomly selected for this study. The writer and two senior students in the University, after approximately 12 to 15 hours of training in the use of the Ayres' Measuring Scale for Handwriting, independently rated each of the approximately six thousand samples. The final score assigned to each paper was the mean of the three rater's scores.

The findings revealed test quality scores of 41, 46, and 50, usual handwriting quality scores of 38,

45, and 47, and speed scores of 69, 90, and 104 letters per minute for the sixth, ninth, and twelfth grades respectively.

The sixth grade group, which is the only one of the three for which norms appear on the Ayres Scale is, with a mean test scores of 41, thirteen points below the sixth grade standard of 54. The sixth grade mean speed score of 69 is just two points below the Ayres standard of 71 for grade six. According to these standards approximately 87.5 per cent of the sixth grade pupils are below their grade quality standard and 80.6 per cent are below the sixth grade speed standard.

If the quality score of 60 which is most frequently set as the minimum adult quality standard is used as a basis of attainment, then approximately 82.7 per cent of the ninth graders and approximately 78.7 per cent of the twelfth graders tested are below standard.

From the results of this study, the following conclusions seem warranted:

1. The handwriting attainment of most pupils in the ninth and twelfth grades in this study is not adequate for either social or vocational needs of adults.
2. The mean scores of both quality and speed of handwriting for the sixth, ninth, and twelfth graders in this study indicate that progress is probably continuous throughout the twelve grades.
3. There exists a very real need for improvement of handwriting in our schools.
4. Good handwriting conserves time and energy of the reader.
5. Most pupils do not write their best in much of their daily work.
6. Widest variation was found in the quality of the handwriting of the best writers.
7. There exists great variability of attainment in both quality and rate not only among the school systems cooperating in this study, but also within most schools.
8. In spite of having been taught manuscript writing in the earlier grades, the number of students in any one of the three grades studied who used manuscript writing entirely or in certain letter formation was negligible.
9. There exists little uniformity in any of the characteristics of handwriting between schools or even between members of the same class.
10. Sixth grade pupils in the larger school systems were found to write better than those attending smaller schools.
11. Noting that in some schools no pupil wrote above a quality level of 40 while in others scores ranged to 70 and 80, indicates that quality of instruction enables pupils to reach a higher level of attainment.
12. There is no significant difference between the rates of handwriting of the best and the poorest writers in any of the three grades studied.

Microfilm copy of complete manuscript of 366 pages, $4.58. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1372.

A STUDY OF THE EFFECTIVENESS OF AN ORAL ARITHMETIC PROGRAM PREPARED FOR USE AT THE INTERMEDIATE GRADE LEVEL

(Publication No. 5468)

Mary Frances Flournoy, Ph.D.
State University of Iowa, 1953

Purpose

The primary purpose of this study was the preparation of an oral arithmetic program composed of a series of lessons planned in detail and designed for use by teachers and pupils at the intermediate grade level. Through using this oral arithmetic program in the classroom, the following major problems were investigated:

1. Pupil growth in ability to solve, without paper and pencil, examples and word problems presented orally
2. General growth in written arithmetic with particular attention to growth in ability to solve written word problems
3. Ways pupils think when performing each of the fundamental arithmetical processes without using paper and pencil
4. General acceptance for oral arithmetic lessons on the part of teachers and pupils

Procedure

A total of 550 pupils in twenty classrooms took part in this program. A booklet of plans, including directions, oral tests, and oral arithmetic lessons, was sent to each participating teacher in September. Other materials provided were answer sheets and written tests. The program extended over fifty-three school days. On completing the plans, test answer sheets were returned to the writer. These were scored and analyzed to determine significance of mean gains on the oral and written computation and problem-solving tests. Written explanations of pupil thinking, when performing the fundamental processes without paper and pencil, were secured and studied. Teacher and pupil reactions to the oral arithmetic program were obtained by means of letter writing.

Results

1. Nineteen of twenty classes made statistically significant gains in ability to solve, without paper and pencil, examples and word problems presented orally.
2. Every class made a statistically significant gain on the teacher-made test of pupil ability to solve written word problems with paper and pencil.
3. Six classes studied were found to have made normal progress on a standardized written problem test.
4. The gain on the teacher-made written computation test was found to be statistically significant in sixteen of nineteen sixth grade classes.
5. In six classes studied a better than normal growth was made in the average grade-equivalent on a standardized written arithmetic test.

6. Pupils at the upper and lower levels of arithmetical ability, as this was determined by standardized test scores, showed highly satisfactory gains on oral computation and problem-solving tests.

7. Solving oral word problems was found to be a more successful experience for pupils at the lower level of arithmetical ability than was solving written word problems.

8. With the exception of the division process, the majority of pupils, after instruction, were using other methods for oral arithmetic than the regular paper and pencil procedure. Before instruction, pupils had used very few "short cut" methods.

9. Besides insuring general pupil growth in oral arithmetic, teachers judged the program to be well-liked by pupils and to possess other features of educational value to them.

10. In addition to thinking it was fun, the majority of pupils expressed a liking for oral arithmetic because they felt that the lessons had helped them to improve in their general ability in arithmetic and because they could work faster.

Educational Implications

1. The undue amount of school arithmetic time that is spent on written computation to the almost complete neglect of oral arithmetic should be seriously questioned and some adjustment made.

2. It is judged highly probable that reasonable, systematic use of an oral problem-solving procedure would considerably improve pupils' ability to read and solve written word problems.

3. Success in oral arithmetic requires greater understanding of numbers and arithmetical processes than does written arithmetic.

4. An effective oral arithmetic program can be carried on at the intermediate grade level without hindering progress in written arithmetic.

Microfilm copy of complete manuscript of 281 pages, $3.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1373.

THE RELATIONSHIP BETWEEN MATERNAL BEHAVIOR AND THE CHILD'S EARLY ADJUSTMENT TO NURSERY SCHOOL

(Publication No. 5475)

Ruth Leah Highberger, Ph.D.
State University of Iowa, 1953

The general aim of this study was to investigate the relationship between certain kinds of maternal behavior and the two-year-old child's early adjustment to school. Four variables from the Fels Parent Behavior Ratings were used as measures of maternal behavior. A measure was devised to evaluate the child's early adjustment to school.

For the measure of the child's early adjustment to school, a list of 80 behavior items was compiled. Fifty-four of these items were selected by a panel of judges (three nursery school teachers and a clinical psychologist) as pertinent to the child's early adjustment to school. A group of 20 judges (leaders in the field of nursery school education and nursery school teachers) sorted three variations of these items according to frequency into 11 groups ranging from those indicating the lowest degree of adjustment to those indicating the highest degree of adjustment if the particular behavior in question was exhibited at a certain frequency. The ranked items were scaled by the method of successive intervals.

The subjects for this study were 38 children (19 boys and 19 girls) between two and three years of age and their mothers. Mothers were rated by a trained and experienced rater on four variables of the Fels Parent Behavior Ratings on the basis of two home observation interviews. The four variables on which mothers were rated were direction of criticism, affectionateness, acceptance, and democracy of policy.

The children were divided into two groups for their nursery school experience, one group meeting in the morning during the summer session and one in the afternoon during the first part of the fall semester. The nursery school situation was kept as nearly as possible the same for both groups of children. Two persons observed the children during their second and third weeks in school and rated them on the Early Adjustment to School Scale at the end of this period.

The over-all between-rater reliability for these ratings was .92 for the Group A and .91 for the Group B. Rank order correlations between the scale ratings and teachers' subjective ratings yielded a rho of .74 for the Group A and .63 for the Group B.

Correlations between measures of maternal behavior and measures of the child's early adjustment to school were low positive for the summer group and low negative for the fall group. Possible reasons for lack of substantiation of the hypothesis are given.

It was concluded that in spite of the results of this study the hypothesis may still be considered tenable; also that the usefulness of the Early Adjustment to School Scale was demonstrated by its high reliability and its relationship with teachers' ratings of child adjustment at the end of six weeks in school.

Microfilm copy of complete manuscript of 103 pages, $1.29. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1374.

THE CONTRIBUTION OF SPEECH AS EDUCATIONAL METHOD TO TEACHING AND LEARNING PROCEDURES IN THE CLASSROOM

(Publication No. 5897)

Elizabeth May Jenks, Ph.D.
University of Washington, 1953

Supervisor: Curtis T. Williams

Speech has long been used as a tool in the conduct of human affairs. As such it has received recognition in the classroom. It is and has been one of

the chief means by which teaching and learning have proceeded.

In studying the use of speech in the classroom, the writer has been impressed by the realization that the recognition given to speech has been largely in the realm of its use as a tool to be employed by individuals to communicate with others. Its importance as a means to individual and social development has been noted also.

The writer has been impressed, also, by the realization that a variant emphasis might be given to speech as it functions in the classroom. Speech is important as an instrument to be used in furthering the general process of education as it proceeds daily in the classroom quite apart from its function as a skill to be used in the oral communication of thought, and from its value in personal and social accomplishment.

The study directs the attention of the reader, then, to the contribution which speech may make to teaching and learning procedures in the classroom. It asks the reader to consider speech in terms of educational method rather than as subject to be mastered or a skill to be trained.

Preparation for the study includes the experience of the writer as a teacher of speech, the observation of the functioning of speech in numerous classrooms at various grade levels, and experimentation on the part of the writer in training teachers to consider speech as a contributor to methodology rather than as personal asset or skill. The approach to speech developed in the dissertation is one presented in the course "Speech in the Classroom" which has been given at the University of Washington over a period of ten years.

The method employed is analytical, descriptive, and, in a sense, evaluative. It is not statistical. There is no endeavor to analyze and to evaluate statistically the contribution which speech may make to teaching and learning procedures; rather, the endeavor has been to describe procedures, which in the experience and observation of the writer and in the experience of teachers employing this approach to speech, have been found valuable.

Two main considerations are presented. In the first place, the reader is furnished with basic information in regard to speech. This is given through a brief analysis of the present understandings in regard to speech, through a discussion of considerations given to speech in texts on speech methods, in texts on general methods, in language arts texts, and in selected courses of study in language arts. Emphases are noted.

The second consideration or issue, the description of procedures in speech of value in teaching and learning, is introduced by a brief discussion of educational methodology. The elements of method found in speech are then indicated. The direct consideration of the second issue includes a detailed discussion of two procedures which speech furnishes to methodology.

The two procedures are silence and sound. The study of silence involves a detailed description of certain techniques. These techniques are those of looking, listening, relaxation, pausing, and certain basic attitudes. The study of sound as a procedure involves a detailed description of the techniques of ideal development, and vowel and consonant flexibility.

The conclusion states that speech as educational method contributes to teaching and learning in three major ways. It is a method in its own right. It complements and supplements the silent way of learning. It brings to any method in the classroom procedures, which through techniques described, may serve as contributing instruments in the teaching and learning process.

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SOME FACTORS AFFECTING VARIATIONS IN THE QUALITY OF STUDENTS' WRITING

(Publication No. 5922)

Gerald Lloyd Kincaid, Ed.D.
Michigan State College, 1953

Statement of the Problem

The purpose of this thesis was to determine whether a single paper written by a student on a given topic at a particular time can be considered as a representative sample of his writing ability — and thus provide a valid basis for evaluating ability at any time in a writing course. The use of a single paper for evaluating a student's achievement under such conditions involves four basic assumptions.

1. that any given topic provides the same stimulus as any other topic,
2. that any given topic elicits constant responses at different times,
3. that the psychological pressure introduced by an examination situation has no adverse effect on the quality of writing, and
4. that the quality of writing is stable from topic to topic and from time to time for any student regardless of writing ability.

Methodology

The data for testing those assumptions were obtained by having four groups of students write two papers on different topics on each of two different days. Two groups, A and B, wrote on both days without the pressure of an examination situation. The other two groups, C and D, wrote their two papers on the first day without the examination pressure. On the second day, however, they wrote their two papers on the same two topics under the pressure of the examinations situation. Thus, groups A and B provided a basis for determining variations in the quality of writing due to topics on each day and due to efficiency variations from the first to the second day, and provided a control group for determining the effect of pressure on groups C and D.

Findings

From the analysis of the average writing performance by groups of students, it was found that: neither the content factors, due to the different topics assigned, variations in the efficiency of students from day to day on the same topics, nor the psychological pressure introduced by the final examination situation had any significant effect on the average quality of writing by a group of twenty or more students.

From the analysis of the writing performance by individual students in each group, it was found that:

1. content factors and variations in efficiency were about equally responsible for significant variations in the quality of writing by 47 of the 80 students involved in the study; and those variations occurred with significantly greater frequency for the strong students than for the weak students.

2. for the strong students, dissimilar topics were responsible for no more significant variations than were the similar topics. For the weak students, however, dissimilar topics did seem to result in a significantly greater frequency of variations in the quality of writing than did similar topics.

3. the psychological pressure of the examination did not result in a significantly greater frequency of gains and/or losses for individual students than when that pressure was absent.

Implications

From the results of this study, it seems reasonable to conclude that for the purpose of evaluating student achievement at any time, or for the purpose of evaluating improvement of individual students in a writing course, samples of writing should be obtained on different topics on the same day and on the same topics on different days.

Microfilm copy of complete manuscript of 124 pages, $1.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1376.

THE VISUAL ARTS IN THE ELEMENTARY SCHOOL

(Publication No. 5694)

Roland Leipholz, Ed.D.
University of Michigan, 1953

It has been observed and substantiated in the literature on art education that classroom teachers, as well as art teachers, often experience difficulty in relating the visual arts to classroom teaching and to the curriculum. It is the purpose of this work to offer a suggested solution for this difficulty. The ideas presented here, supplementing the usual content and objectives of art education, are intended to help teachers plan a more coherent program of artwork and to initiate a number of art activities that will serve to enrich the learning of the children in whatever grade they may be.

The first concern is with the satisfaction of basic human values and needs through an enrichment of the art program and its integration with other values. Granted that the proper techniques are employed, if art is permitted to function freely as it should, and if the school subjects and activities are thought of as a means for the promotion of human values, not only will the various experiences have more meaning for the child, but his total experiences will be more satisfying and his life adjustment more adequate.

The problem is approached from a point of view representing an extension, adaptation, and combination of three general theories: the place of human values in the elementary school, the instrumental values of art, and an organic and dynamic approach to creativity.

The place of human values in the school. - Human values constitute the proper basis for formulation of educational objectives and the selection of content, therefore the values should constantly serve as points of reference in determining the nature of the school program. For purposes of this work, six basic human values have been used. These are referred to as physical, intellectual, occupational, adjustment, social, and esthetic. If the subject matter and activities of the school are organized with values as objectives, the art program can contribute advantageously to each.

The instrumental values of art. - Art is here viewed as having a dual function: it can enrich the school program and so enhance the value of other experiences, and it can, itself, provide true psychological satisfactions. Thus, it may be said that it enriches life experiences and in so doing tends to integrate the other values. An effective art program should, therefore, be worked out in a relation to the other values, and when this is done, a basis for integration is provided.

The Organic approach to creativity. - The much misused term art, is here used not as synonymous with the fine arts, but includes artistic activity of any kind. The approach described is based on four elementary techniques that are fundamental to creativity, namely, surface treatment (painting, drawing, and, printing), hand-sculpture (sculpture and ceramics), arrangements (design), and constructions (the crafts). Together, they represent a functional approach to the creative arts as contrasted with the traditional approach.

Extensive lists of suggestions for creative expression are provided, grouped under the different values and classified according to the school subjects and activities. Evaluation scales for teacher use are followed by a selective list of sources where art materials may be obtained, including visual aids and a bibliography of useful art books and manuals.

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COMPARISON OF ELEMENTARY AND JUNIOR HIGH SCHOOL CLASSROOM MUSIC

(Publication No. 5771)

Chester William Mason, Ed.D.
Stanford University, 1953

This investigation of classroom music in the elementary schools and junior high schools of the San Jose Unified School District compared sixth grade classroom music taught by regular classroom teachers in "self contained" classroom situations with seventh grade classroom music taught by special music teachers in departmentalized situations. The sources of information were questionnaires, interviews, a student attitude scale, a standardized music achievement test, classroom observations, and diary-like teacher logs.

Purpose

The purpose of the study was to discover the similarities and differences between sixth and seventh grade classroom music in the San Jose schools. It shows how the elementary music program taught by the classroom teacher compares with that taught by the music specialist and determines how the change from the "self-contained" classroom to the departmentalized situation affects the music program. The study provides data for organizing and administering effective classroom music programs.

Procedure

Information was gathered between February 2, 1951 and September 1, 1951. A sixth grade sample was taken from nine schools and included fifteen teachers who taught 546 pupils in fifteen "self-contained" classrooms. The seventh grade group came from four junior high schools and included five teachers teaching 434 pupils. Two additional classes were used for preliminary trying out of instruments and techniques.

The music objectives, programming of music classes, classroom music teaching, content and materials of the music classes, and teacher, student, parent and administrator reactions to the classroom music program were analyzed and compared.

Conclusions and Recommendations

Although many similarities were found in sixth and seventh grade classroom music, important differences also existed. These differences were greatest in the programming of music classes and in the kind of equipment available.

Singing was the basic activity in both grades. All data indicated sixth grade teachers emphasized singing while seventh grade teachers emphasized musical facts.

Development of music reading ability and knowledge of music facts were not adequate according to parents. Growth in musical knowledge, however, was equal to that of the normative group on a standardized music achievement test. Median scores of both grades were below those shown in the test manual.

"Love and Appreciation" of music, agreed upon as of greatest importance, was adequately developed in both grades. The reactions of students, parents, and administrators indicated the sixth grade music program was the more effective of the two in developing this objective.

Although many music teaching procedures were common to both grades, differences were found in teaching part songs, in the use of program outlets, and in the use of the piano. Carryover was found into home and outside-of-school music activities, according to emphases noted in classroom music.

Differences in musical background and training of teachers at the two levels were reflected in the problems found. Sixth grade teachers asked for help in developing music teaching skills; seventh grade teachers asked for help in solving administrative problems.

Data in the study pointed up small but consistent differences throughout in favor of the elementary school music program. The assumption that elementary classroom teachers should be replaced by special music teachers in order to provide an adequate classroom music experience is refuted by this study. The need for organizing developmental music experiences in each area of music education was demonstrated. More time, which can only be provided if allotments throughout the curriculum are revised, was requested consistently. This and the large number of students that reported they learned "nothing" from classroom music should serve as a challenge to music educators.

Further studies are needed to determine more effective uses of available music time, to evaluate supervisory techniques, and to determine the efficiency of music training courses in colleges.

Microfilm copy of complete manuscript of 497 pages, $6.21. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1378.

WHO CAN AND SHOULD GO TO WHAT KIND OF COLLEGE?

(Publication No. 5822)

Kenneth E. Young, Ph.D.
Stanford University, 1953

Three series of variables have been investigated in this study:

1. The Questions Stated in the Title: (1) who can go to college? (2) who should go to college? and (3) who can and should go to what kind of college?

2. Eight Student Characteristics: Age, sex, race, religion, place of residence, socioeconomic status, educational preparation, and intellectual ability.

3. Historic, Recent, and Current Points of View: The two sets of variables listed above have been interrelated temporally. Chapters One and Two review the history of student admission practices in relationship to the first seven of the student characteristics; Chapter Three shows how the Depression, the war, and its aftermath led strong minority groups

to abandon the philosophy of gradualism in the improvement of college admission practices and to drive vigorously for immediate elimination of existing discriminations; Chapter Four analyzes the positions on college admissions of the President's Commission on Higher Education and the New York Commission on the Need of a State University, both of which reported in 1947-48; Chapter Five explores the thinking of two leading educators on these issues — James Bryant Conant and Robert Maynard Hutchins — and particularly on the question of student intellectual ability.

The study shows (1) that the question "who should go to college" is defectively stated since the nation supports at least a score of different kinds of post-high-school educational institutions including the junior college, various structures known as institutes, the unitary or independently organized liberal arts college, several kinds of vocational colleges attached to state universities, as well as law schools, medical schools, theological schools, the graduate school of arts and sciences; (2) that discriminations against the admissions to these educational structures have been lessening throughout American history and have been very considerably reduced during the past fifteen years; and (3) that educational preparation and intellectual ability, although sometimes thought to be discriminatory factors in college admissions, are not such when the nation provides differential institutions to meet the educational needs of students with differing preparations and differing constellations of intellectual and other ability.

Microfilm copy of complete manuscript of 214 pages, $2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1379.

EDUCATION, ADMINISTRATION

A STUDY OF COGNATE WORK IN THE PROGRAM OF PREPARATION FOR SUPERINTENDENTS OF SCHOOLS

(Publication No. 5659)

William Harold Dawe, Ph.D.
University of Michigan, 1953

The purpose of this study is to determine the relationship and value of the subject matter content from fields of study other than education for reinforcing and supplementing the professional preparation of school superintendents. The study brings together an outline of major contributions of materials from cognate areas which will be useful to those responsible for developing the program of preparation for school administrators and to the student and faculty adviser in planning a program of study in the related disciplines fitted to the individual needs of the prospective administrator.

First, a consideration of the need to tap fields of study other than education for materials valuable to the program of preparation for school superintendents is presented. Eleven statements concerning characteristics of relationship between the cognate field materials and the specialized program of administrative preparation were formulated and presented for evaluation to professors of educational administration and to practicing administrators. It is felt that the degree to which these characteristics were endorsed has established them as principles of relationship which exist between the cognate fields and the professional preparation for school superintendents. Judgments of respondents as to the degree to which these principles were being emphasized in programs preparing for school administration were considerably lower than the judgments as to the value of the principles.

Second, selected topics from the related fields of study were evaluated: (1) in regard to the value of the topic in the program of administrative preparation, and (2) in regard to the extent to which prospective administrators were achieving understandings of these topics. From this questionnaire evaluation by professors of school administration and practicing administrators, indices were computed to show: (1) the degree of endorsement the topics of each field received, and (2) the extent to which understandings of the topics were estimated to be achieved by prospective administrators.

In conjunction with the portion of the study in which selected topics from related fields were evaluated in relation to their value to the program of preparation for school administrators, a free response two-item questionnaire was submitted to forty professors of school administration to determine: (1) institutional practice in relation to utilizing materials from the related fields in the program preparing for school administration, and (2) a consensus as to which related area materials hold greatest significance for preparatory programs for school leadership. This two-item device was used essentially as a control to insure emphasis upon relevant cognate materials and also in the hope that it would aid in a better appraisal of the findings of the study.

Two general conclusions can be drawn from the study.

(1) There is a need to draw upon the resources of cognate fields to reinforce and supplement the professional preparation of school administrators. (2) The related area materials which have greatest significance for programs of preparation for school administrators may be said to fall into such broad fields of study as: public finance, techniques of research, techniques of communications, problems of site selection and plant design, aspects of individual and group behavior, governmental arrangements, problems of sociology and population change, public administration, and economic foundations of the community.

Microfilm copy of complete manuscript of 278 pages, $3.48. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1380.

ENGINEERING, AERONAUTICAL

ENGINEERING APPLICATIONS OF THE THEORY OF TIME-DEPENDENT ELASTICITY

(Publication No. 5634)

Harold Frederick Allen, Ph.D.
University of Michigan, 1953

The advent of supersonic aircraft and missiles, with attendant aerodynamic heating of such magnitude that the strength and elastic properties of common structural metals may be seriously affected, has confronted the aeronautical engineer with problems which current aircraft design procedures are not adequate to solve. It is customary to design an aircraft structure on the basis of static "ultimate" loads which are found by applying an arbitrary factor of safety to "limit" or "applied" flight loads. However, the time-dependence of material properties and the rapid creep exhibited by metals at high temperatures may make it impossible under such conditions to simulate the effect of time-dependent loads by means of static loads. Consequently, at present there are no rational procedures for the structural design of high-speed supersonic aircraft and missiles.

Theoretical studies of inelastic material behavior based on the simulation of materials by means of "linear solids," consisting of springs and viscous dampers, have been carried out by a number of investigators, but there have been practically no engineering applications in the structural field. This investigation was undertaken in order to apply a recently developed theory of time-dependent elasticity to the solution of a number of relatively simple structural problems, to develop experimental methods of determining the required constants, and to carry out experimental checks of some of the theoretical results, in the hope that the solutions of simple problems can be adapted to more complex situations, and may thereby serve as the basis from which rational design procedures may be developed.

The theory was applied to the prediction of the elevated temperature deflections involved in tension creep tests, beams with arbitrary loads and methods of support, harmonic vibrations, and Euler columns. The cantilever beam with a concentrated load at the free end was adopted for the experimental determination of the required constants, and this determination was carried out for 17 ST and 24 ST aluminum alloys at various temperatures. A vibrating cantilever with a large mass at the free end was selected to serve as a check.

The predicted attenuations of the vibrating beams agreed well with the test values at the higher temperatures, where the creep was rapid, but there were substantial differences at lower temperatures. It is therefore recommended that, pending further investigations, the representation of material by "linear solids" be limited to materials which exhibit rapid creep. The application of the theory to simple problems involves calculations which are time-consuming, though not difficult, and it is suggested that analog computers may be adaptable to the solution of more complex problems.

Microfilm copy of complete manuscript of 127 pages, $1.59. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1381.

AN ANALYTIC DESIGN METHOD FOR A TWO-DIMENSIONAL ASYMMETRIC CURVED NOZZLE

(Publication No. 5696)

Hans Peter Liepman, Ph.D.
University of Michigan, 1953

An analytic method is presented for the design of two-dimensional asymmetric curved nozzles. Such nozzles are of interest to designers of supersonic test facilities since they can achieve continuously varying Mach numbers by relative translation of one contour with respect to the other. Since such nozzles can also be designed without discontinuities in their wall curvatures, they have many desirable features. The only known method of designing this type of nozzle has been the graphical one of characteristics. Since it is shown that a graphical method is not accurate enough to assure the high quality of uniform flow desired in the test section, the need for an analytic design method is apparent.

The continuity equation and the condition of irrotationality for steady compressible flow are given in curvilinear co-ordinates with stream function and velocity potential as independent variables. Using Bernoulli's equation for an isentropic gas and a suitably chosen analytic velocity distribution along the initial expansion contour, which is specified in terms of its curvature, a set of partial differential equations is obtained. These equations are solved by expanding the dependent variables - velocity q, flow direction θ, and curvilinear co-ordinates (x, y) of a streamline - in powers of the stream function. This solution determines the nozzle contours for any constant value of the stream function as well as all flow characteristics in the subsonic region and the supersonic expansion region of the nozzle. After the patching Mach line is calculated numerically the recompression contour can be determined to complete the nozzle calculations. The effect of curvature of the initial expansion contour on the flow near the throat, the patching Mach line, and the test section juncture is immediately apparent since the first order terms of the curvature parameter appear in the equations.

The actual application of this analytic method is then carried out for the design of a perfect fluid contour for a design Mach number of 2.37.

The variation of Mach number by relative translation of fixed contours of the asymmetric type is then discussed. An iteration method is derived for this purpose which should converge very rapidly as compared to the iteration required by the characteristics method of design.

Finally the problem of boundary layer corrections to this type of nozzle is reviewed. A criterion is suggested to determine if viscous corrections are needed or not. The actual process of carrying out such corrections is also indicated.

Microfilm copy of complete manuscript of 121 pages, $1.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1382.

ENGINEERING, CHEMICAL

VERTICAL, UPWARD, ANNULAR, TWO-PHASE FLOW IN SMOOTH TUBES

(Publication No. 5646)

Seymour Calvert, Ph.D.
University of Michigan, 1952

"Vertical, Upward, Annular Two-Phase Flow in Smooth Tubes" is a study of the regime of co-current, two-phase flow which is characterized by the liquid running as a film along the tube wall. This investigation involved the application of the concept of flow mechanisms to the case of film-flow, an experimental study of the flow of air and water, and an analysis of the momentum exchange between the two fluids. Data were taken for a range of air rates from 10 - 74 cubic feet per minute and water rates from 0 to 300 lbs/hr. for one-inch I. D. tubes; and over a range of air rates from 55 to 112 cubic feet per minute and water rates from 0 to 2000 lbs/hr. for the two-inch I. D. tube.

Using fundamental principles of fluid dynamics, a relationship was developed which predicts film thickness and velocity for any liquid flowing in an annular film as a function of pressure drop, flow rate, tube radius and kinematic viscosity. The theoretical predictions agree with data for air-water systems. Pressure drop as a function of gas rate is predicted for air-water systems by an empirical correlation of the drag coefficient for the liquid surface, based upon reported pressure drops for an air-water, annular flow system. Using these two relationships, a theoretical one for the liquid film and an empirical one for the gas phase, pressure drops are predicted which agree well with those measured over the experimental range studied.

A general criterion of turbulence in liquid films is developed.

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CONVECTIVE HEAT TRANSFER FROM A GAS STREAM AT HIGH TEMPERATURE TO A CYLINDER NORMAL TO THE FLOW

(Publication No. 5651)

Stuart Winston Churchill, Ph.D.
University of Michigan, 1952

The overall rate and the angular variation of the rate of convective heat transfer from a gas stream at high temperature to a circular cylinder normal to the flow were measured.

The investigation was made with a nitrogen gas stream at one atmosphere pressure, a series of flow rates and a series of temperatures from 580° F. to 1800° F. The outer surface of a cylindrical tube was maintained at about 100° F. by cooling water circulation. Measurement of the radial temperature profile through a thermally-isolated 30-degree annular sector of the tube wall permitted calculation of the incremental heat transfer rate over the corresponding 30-degree arc of the cylinder surface by the classical equation for conduction, and determination of the surface temperature by extrapolation. The gas temperature was measured by a thermocouple in an adiabatic, packed bed through which the gas was passed before entering the test zone. Measurements were made at a series of 30-degree steps as the test cylinder was rotated through 360 degrees.

The overall heat transfer rate was obtained by numerical integration of the incremental rates and the local heat transfer rates were obtained from an integral curve drawn through the incremental rate data.

Previous correlations for convective heat transfer based upon experiments with small temperature differences did not adequately represent the data obtained in this investigation. However, the experimental data for overall heat transfer rates were represented with an average deviation of 3.4 percent by the equation

$$\frac{hD}{k} = 0.60 \left(\frac{C_p \mu}{k}\right)^{1/3} \left(\frac{DG}{\mu}\right)^{1/2} \left(\frac{T_b}{T_s}\right)^{0.12} ,$$

where h is the heat transfer coefficient, D the diameter of the cylinder, G the mass velocity, T_b the absolute temperature of the bulk gas, T_s the absolute temperature of the cylinder surface, and μ, k, and C_p are the viscosity, thermal conductivity and constant pressure heat capacity of the gas, respectively, evaluated at the bulk temperature. Since the equation is expressed in terms of dimensionless groups of the variables, any consistent set of units may be used. The flow range covered by the investigation corresponds to a range of DG/μ from 300 to 2300. Data

obtained by previous investigators with low temperature differences over the same range of DG/μ are also well represented by the above equation.

The data for local heat transfer rates were correlated in terms of the same dimensionless groups, but the exponent for DG/μ varied with the angular position of the cylinder. A general graphical correlation was obtained as a function of the angular position.

Consideration of previous investigations with high surface temperatures suggests that data for convective heat transfer between a gas stream and a cylinder for a wide range of temperature differences and for heat flow in either direction might be expressed by a single correlation including the term, T_h/T_ℓ, where T_h and T_ℓ refer to the higher and lower absolute temperatures bounding the system.

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FLOW OF GASES THROUGH CONSOLIDATED POROUS MEDIA

(Publication No. 5761)

David Cornell, Ph.D.
University of Michigan, 1952

Analysis of the behavior of natural gas wells, in order to compute gas reserves, well spacing, and delivery pressures and to evaluate production techniques, requires a knowledge of laminar and turbulent flow through consolidated, porous, reservoir rock and a procedure for computing radial flow in the unsteady state. The purpose of this work was to study the flow of gases through consolidated porous media to provide a basis for understanding the behavior of natural gas wells at production rates leading to turbulent flow. In addition, methods of handling unsteady state flow problems were desired.

The rate of flow of air, helium, methane, and nitrogen through consolidated porous samples (sandstone, limestone, and dolomite core specimens approximately 0.72" in diameter, 1.0" long, and mounted in plastic) was measured for both the laminar and turbulent regions using pressure drops of from 0.5 - 1,000 pounds per square inch per inch. The porosity, ϕ, of the samples varied from 2 - 23% and was measured by the liquid saturation technique; the electrical resistivity factor, F, was measured with the samples saturated with a salt solution of known conductivity; and the pore size distribution in the range of pore diameters from 6×10^{-5} to 2×10^{-4} feet was measured for selected samples by means of the capillary pressure technique.

The data were correlated by means of the equation,

$$\frac{(P_1^2 - P_2^2)_f}{L_B} = \frac{32\,F}{k_1 D_E^2} \cdot \frac{2\,zRT\mu G_S}{M\,g_c} + \frac{32\,F^{3/2}}{k\,D_E \phi^{1/2}} \cdot \frac{2\,zRT\,G_S^2}{M\,g_c} .$$

Plots of $[(P_1^2 - P_2^2)_f \cdot M\,g_c/L_B\,2\,zRT\mu G_S]$ versus (G_S/μ) for which the intercept is $\alpha = (32\,F/k_1 \cdot D_E^2)$ and the slope is $\beta = (32\,F^{3/2}/k_2 \cdot D_E \cdot \phi^{1/2})$ were made for the data points not affected by molecular streaming. The friction factor and Reynolds number become,

$$f = \frac{64\,g_c\,(1/\beta)\,\rho\,(-\Delta P_f)}{L_B\,G_S^2} = \frac{2\,g_c\,D_E\,\rho(-\Delta P_f)\,k_2\,\phi^{1/2}}{L_B\,G_S^2\,F^{3/2}}$$

$$= \frac{2\,g_c\,D_E\,(-\Delta P_f)\,k_2}{L_E\,v_E^2\,\rho}$$

and

$$Re = \frac{(\beta/\alpha)G_S}{\mu} = \frac{D_E\,G_S\,F^{1/2}\,k_1}{\mu\,k_2\phi^{1/2}} = \frac{D_E\,v_E\,k_1}{\mu\,k_2}$$

The first forms of f and Re may be used in correlating flow data, the second forms may be used in predicting flow data, and the final forms are the fundamental forms from which the other two are derived. The geometrical constant k_1 is closely related to the Kozeny constant and has been taken as 0.5 here. The geometrical constant k_2 may be correlated with the relative roughness, ϵ/D, in the case of pipes. A correlation of k_2 with D_E, the effective pore diameter, is presented here with the variety of the material as a parameter, it being assumed that ϵ, a shape factor, is relatively constant for a given type of material.

Equations for predicting flow through consolidated porous media together with data on twenty-four consolidated samples are presented. Brownell's correlation procedure has been analyzed further. A method of measuring the Kozeny constant directly has been given. The length of the path through porous media has been measured experimentally. Using this fluid flow theory and the well known Schmidt method for the graphical solution of partial differential equations, unsteady state radial flow problems involving turbulent flow are solved for a number of boundary conditions. Empirical back pressure tests made on natural gas wells have been compared with the more exact procedures of analysis made available by this research.

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SALT EFFECT IN VAPOR-LIQUID EQUILIBRIA

(Publication No. 5589)

Edward T. Fogg, Ph.D.
University of Pennsylvania, 1953

Supervisor: A. N. Hixon

A critical discussion of various vapor-liquid equilibrium still designs is given with particular reference to the application to salt effect studies.

A low-temperature vacuum distillation apparatus which makes possible the quantitative separation of high boiling liquids from salt-liquid mixtures is described and evaluated.

Analytical data for ethylene glycol-water mixtures are reported in the form of a density-composition curve (at 25° C) and in the form of a refractive index-composition curve (at 20° C).

Experimental vapor-liquid equilibrium data and temperature-composition data obtained in a Gillespie equilibrium still are reported over the entire composition range and at atmospheric pressure for the ethylene glycol-water binary system and for the following salt-saturated systems:

Ethylene Glycol-Water-Sodium Sulfate
Ethylene Glycol-Water-Potassium Chloride
Ethylene Glycol-Water-Potassium Bromide

The effects of the salts on relative volatility and on activity coefficients are also shown.

An empirically derived correlation is proposed which effectively related the fractional change in the activity coefficients of both components, caused by the addition of a salt, to the solubility of the salt in the pure components. When applied to the data of other investigators for ethanol-water-salt systems, this type of correlation holds for the fractional change in the activity coefficient of the water but not for that of the ethanol, since all of the salts used were insoluble in the alcohol. An additional limitation is that this correlation fails for systems in which the salt combines or reacts in any way with either of the liquid components.

All available published data on the salt effect in vapor-liquid equilibria are summarized, and suggestions are made for further work.

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AN INVESTIGATION OF BRIDGING VELOCITIES AND PRESSURE DROP FOR ISOTHERMAL COUNTERCURRENT FLOW OF GAS AND LIQUID IN VERTICAL WETTED WALL TUBES

(Publication No. 5692)

Richard Reist Kraybill, Ph.D.
University of Michigan, 1953

Bridging or flooding in wetted wall smooth glass tubes was investigated for the following systems at room temperature and atmospheric pressure:

Tube Dia., in.	Tube Length, in.	Fluid Systems
3/8	18-1/2, 37-1/2, 56	water-air
	37-1/2 (or 56)	water-air, carbon dioxide, helium, Freon-12, propane
3/4	72	water-air, helium, hydrogen, carbon dioxide, propane, Freon-12
		Air-Aerosol, butyl alcohol, three sucrose solutions
1-1/2	60	Air-water
3	65	Air-water

Diameter

The locus of bridging volumetric flow rates in each of the 3/8-inch tubes showed the presence of a minimum which is the result of ripples on the liquid surface. At higher liquid rates (Q_l) the ripples disappear causing a maximum, but at low rates the height of the ripples approaches the radius of the tube and a lower air rate (Q_g in cfm) needed to bridge. No minimum was observed in the air-water bridging locus for the larger tubes indicating that the critical diameter for the ripple height bridging lies between 3/8 and 3/4 inches.

Length

The effect of tube length is very slight for flow rates above the ripple region, but in the ripple range increasing wave height accompanies increasing tube length and the liquid film bridges at lower gas rates.

Gas Properties and Pressure Drop

The effect of gas properties was well correlated by plotting $Q_g\sqrt{\rho g\,(Re_l)_g}^{\,0.12}$ versus liquid rate for bridging in a given tube. A similar curve was obtained when plotting pressure drop versus liquid rate. The slopes of superficial gas friction factor versus superficial gas Reynolds number gave a positive slope indicating that the liquid surface becomes rough just before bridging.

Liquid Properties

The loci of bridging flow rates for six liquids and air in the 3/4-inch tube presented anomalous patterns in that all but water formed minimum and maximum points. The minimum points corresponded to the ripple disappearance points and were correlated at $m\,(Re)_l^{\,0.59} = 0.126$ feet where m is the liquid film thickness calculated from Nusselt's equation for laminar flow and $(Re)_l$ is liquid Reynolds number. Bridging in the ripple range was correlated as a plot of

$$\frac{(V_g)_c^{\,2}\,\rho g\,(Re')_g^{\,0.24}}{g_c(\rho 1 - g)\,(Re)_l(\gamma)^S(D)^{\alpha}} \text{ versus } \Sigma = m(g/g_c)\,(Re_l)^{0.59}.$$

The ordinate is a function of (1) shearing stress which in turn is a complex function of gas velocity, density, and Reynolds number and wave form or surface roughness, (2) surface tension, (3) gas buoyancy and (4) diameter. Exponents of surface tension, $(Re)_l$ and diameter terms in the abscissa expression were found to be functions of the ordinate, Σ.

Bridging

The mechanism of bridging is postulated as a disruption of the liquid surface resulting from rapid growth in amplitude of unstable surface waves. The instability is generated when the aerodynamic shear forces and Bernoulli pressure effects overcome the surface stabilizing effect of surface tension. Two inherent tendencies of liquid films appear to promote film instability: (1) ripple and (2) eddy formation. As liquid rate increases for laminar film flow at the ripple disappearance point, a temporary improvement in stability results in a minimum point. Then, as increasing liquid rate and turbulence decrease stability, a maximum point is formed. Apparently water films attain turbulent flow, $(Re)_l > 1500$, coincidentally with ripple disappearance so no temporary improvement in stability or minimum-maximum phenomenon occurs.

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UNSTEADY-STATE MASS TRANSFER FROM GAS BUBBLES: LIQUID-PHASE RESISTANCE

(Publication No. 5902)

Pang-Sheng Li, Ph.D.
University of Washington, 1953

The two-film concept has been the basis for correlating data on gas-liquid or liquid-liquid contact in terms of gas-film and liquid-film resistances, although the films may not exist.

For the major industrial mass transfer equipment, packed towers for gas absorption, for example, the mass transfer coefficient, K_L and effective contact area per unit volume, a', have been grouped together as K_La' for design purposes and are related to the operating variables based on the two-film concept. The mass transfer is actually accomplished by an unsteady-state process, both in the liquid phase and in the gas phase. It is very important to know the factors affecting both K_L and a'.

The objects of this investigation were to verify experimentally the unsteady-state mass transfer theory for the cases of simple diffusion(Higbie's theory[1]), diffusion for a system with a possible interfacial barrier, as claimed by Higbie, and diffusion with slow reversible reaction.

Three liquid-phase resistance controlling systems, oxygen-water, carbon dioxide-air-water and chlorine-air-water systems were used to study the three respective objects.

To study this subject, it was necessary to design a device to obtain the experimental unsteady-state mass transfer coefficients for comparison with the theory. The apparatus designed should have known area and present short period of contact between the two phases.

Pure oxygen bubbles covering a wide range of bubbling rates and sizes were used for oxygen-water system. Carbon dioxide and chlorine, being more soluble than oxygen at corresponding pressure, were mixed together with a slightly soluble gas, such as air, for absorption, so that constant bubble sizes were maintained. The results have proven the value of bubbling technique in studying the various phases of Higbie's equation.

For the absorption of bubbles of pure oxygen by air-saturated water, the end-effect was corrected by using a short column and a tall one, both filled with water. The liquid was analyzed for oxygen absorbed. The experimental mass transfer coefficient K_L was calculated from the measurable quantities:

$$K_L = \frac{V_{short}}{N\,a\,\Delta t_p\,t_f} \ln \frac{C_o^* - C_{mf(short)}}{C_o^* - C_{mf\ (tall)}} + \frac{V_{tall} - V_{short}}{N\,a\,\Delta t_p\,t_f} \ln \frac{C_o^* - C_{mo}}{C_o^* - C_{mf(tall)}} \qquad (1)$$

For bubbles of mixture of air and carbon dioxide or chlorine, the experimental unsteady-state mass transfer coefficient K_L can be calculated, after end-effect correction, from:

$$e^{-N_{oL(tall)}} = 1 - \frac{RT\,V_{tall}}{H\,v\,N\,t_f} \ln \frac{C_o^* - C_{mo}}{C_o^* - C_{mf(tall)}} \qquad (2)$$

$$e^{-N_{oL(short)}} = 1 - \frac{RT\,V_{short}}{H\,v\,N\,t_f} \ln \frac{C_o^* - C_{mo}}{C_o^* - C_{mf(short)}} \qquad (3)$$

$$\Delta N_{oL} = N_{oL(tall)} - N_{oL(short)} = K_L\,\Delta t_p \frac{a\,RT}{vH} \qquad (4)$$

It has been shown that oxygen transfer from bubbles into water agrees to about ± 10% with Higbie's theoretical equation, $K_L = 1.13\sqrt{D_L/t_e}$, by taking the time for the bubble to rise at its terminal velocity through a distance equal to the minor axis as time of contact. This was found to be the case in spite of differences in geometry, of possible distorsion of the "film," of possible turbulence beyond the "film," and of the various other simplifications made in applying the equation to distorted gas bubbles. No evidence was found for the interfacial barriers to mass transfer for the absorption of carbon dioxide by water although the t_e's were either equal to or smaller than the smallest t_e's used by Higbie. Finally, results for chlorine absorption are in closer agreement with no chemical reaction assumed than with assumed chemical equilibrium during transfer. The observed results are only 15% above Higbie's equation when assuming no chemical reaction. Prediction is improved somewhat by allowing for there being a first-order irreversible reaction with a rate constant of 12.3/sec. extrapolated from the data of Shilov and Solodushenkov.[2]

1. Higbie, R. W., Trans. Am. Inst. Chem. Engrs., 31, 365-89 (1935).

2. Shilov, E. A., and Solodushenkovs, S. N., Acta Physicochimica, URSS, 20, 667 (1945).

Microfilm copy of complete manuscript of 112 pages, $1.40. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1388.

ENGINEERING, CIVIL

AN EXPERIMENTAL STUDY OF THE STRESS AND STRAIN DISTRIBUTION IN STEEL GUSSET PLATES

(Publication No. 5731))

Marlin Lee Sheridan, Ph.D.
University of Michigan, 1953

Laboratory investigations were performed on two steel gusset plates. One plate, loaded in tension only, was symmetrical about the line of load application. Strips of steel were removed progressively from the width of that plate, so that there were produced plates with increasing values of eccentricity of load application. Tests were conducted on all plates of the series thus formed. The second plate, furnished and fabricated by a steel fabricating company, was typical of the gusset plate employed at the end of a truss. A reaction was furnished by a four inch pin, the lower chord member was in tension, and the upper chord member, at an angle of 45 degrees with the lower chord, was loaded in compression.

For all plates there were obtained three sets of curves: trajectories of the major principal stresses, stress contours of the major principal stresses, and stress contours of the minor principal stresses. It was ascertained that the curves were correct and reasonably accurate within the boundaries of the plate, with the exception of those areas of plate in the immediate vicinity of a load carrying bolt or pin. All stress measurements were made within the boundaries of the plates; none were made on the free edges of the plates. Special consideration was given to the center line stress pattern of the first series of plates.

All specimens were tested in a universal testing machine, and in some cases, large specially-built loading fixtures were used. Strains were measured by means of electric resistance wire strain gages and associated equipment. A mechanical-graphical device was utilized for the resolution of the strain readings obtained with rosettes of strain gages.

A survey to determine the validity of various numerical methods of analysis included the common engineering formulas, the formulas modified by a pre-determined correction factor, and the theory of elasticity.

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THE INTERACTION OF TOP CHORDS AND TRANSVERSE FRAMES IN PONY-TRUSS BRIDGES

(Publication No. 5754)

Hsi Hsin Tung, Ph.D.
University of Michigan, 1953

An analytical method for determining the stresses in the members of pony trusses due to the transverse frame action of the floor-beams and verticals when the frames are subjected to concentrated wheel loads is presented in this dissertation. The importance of this problem arises from the fact that the resulting stresses in the truss members may cause primary failure before the buckling load of the top chords can be reached.

The method described is based essentially upon the application of the moment distribution method to the determination of bending moments, twisting moments, and transverse shears due to displacements perpendicular to the plane of the trusses. By using the generalized slope-deflection equations and torsional, two stiffness coefficients (with respect to two perpendicular axes in the plane of the structure) and six carry-over factors are derived which give the simultaneous change in all end moments for any end rotation. In the proposed procedure, the corrections of end moments about one axis are kept separate from the corrections about the other. The numerical operations are not difficult as the convergence is quite rapid. Furthermore, being a numerical method, it is applicable to cases of very complicated nature.

In the course of the study, it is noticed that in practical cases, the results are affected only slightly by the change of primary stresses in the truss members. This leads to the idea of constructing influence lines for various functions, allowing an easy treatment for the determination of critical loading condition, and therefore critical combined stress for any given member. For bridges having more than six panels, satisfactory results may be obtained by the use of an approximate method, in which a simplified structure is employed in the analysis.

In actual structures the top chord members may be initially curved in a horizontal plane, or some panel points may even be slightly out of alignment. The presence of either of these imperfections will set up stresses in all truss members when the top chord is submitted to the axial forces. To obtain some idea as to what the possible effects may be, the stresses in the truss members corresponding to several assumed initial curvatures are evaluated and compared.

The following general conclusions can be drawn from the study. (1) Bending stresses of considerable magnitude may be developed in the members and connections in the transverse frames, which may provide more than sufficient stiffnesses to ensure the stability of the top chords and yet are inadequate in strength. (2) The bending stresses seldom contribute more than 15% of the maximum normal stresses in the top chord members. (3) In practical cases, the ordinates of the influence lines, from which the

critical loading conditions are determined, are not sensitive to the change of direct stresses in the truss member. (4) In general, it appears that the presence of small initial curvatures in the top chord, in a horizontal plane, has no appreciable effect on the truss members.

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ENGINEERING, ELECTRICAL

ON THE APPROXIMATION OF ARBITRARY PHASE-FREQUENCY CHARACTERISTICS

(Publication No. 5797)

Victor Henry Grinich, Ph.D.
Stanford University, 1953

A common problem in electrical network synthesis is the approximation of an arbitrary phase-versus-frequency function by a two terminal-pair network. Solutions have been previously obtained by cut-and-try procedures, the potential analogue or by making use of special properties of known functions.

Recently Darlington has shown how to use Chebyshev polynomial series in order to obtain a nearly equal-ripple approximation to a prescribed attenuation function in both the "low-pass" and "band-pass" intervals. His method can also be used to approximate attenuation and phase simultaneously but in this case only in the low-pass interval. For phase approximation alone, the method has not been fully explored. Here again only the low-pass interval type of problem can be handled.

This study first amplifies the above method to include approximation of an arbitrary phase function in the low-pass interval where the "flat-delay" is unspecified. The resulting approximation techniques can be used for obtaining the Taylor (derivative matching) or nearly equal-ripple solution.

Next the Taylor approximations of (1) arbitrary phase functions and of (2) arbitrary attenuation and phase functions are obtained for the band-pass interval. When the transfer function is a rational fraction certain additional complications arise.

By means of several conformal transformations (including an elliptic function transformation) the solution for the nearly equal-ripple approximation in the band-pass interval can be obtained. Similar to the method employed by Darlington in the low-pass case, this solution makes use of a Taylor type approximation as an intermediate step. In the cases of linear phase or constant attenuation coupled with linear phase the nearly equal-ripple solutions are found to be simply related to the Taylor approximation.

Numerical examples are given which are pertinent to the design of linear-phase networks, phase equalizers, phase discriminators, and constant-phase-difference networks with linear through-phase.

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THE THERMISTOR AS A DEVICE FOR THE MEASUREMENT OF VELOCITY IN FLOWING WATER

(Publication No. 5679)

Edwin Ernest Henry, Jr., Ph.D.
University of Michigan, 1953

The thermistor is a semiconductor whose electrical resistance changes markedly with a small variation in its temperature. When used to measure water velocity, heat is introduced electrically and is transferred from the thermistor to the water. The thermistor temperature depends on the amount of heat introduced, the size and shape of the thermistor, and the water temperature and velocity. It is the purpose of this thesis to study, by a heat transfer approach, the operation of the thermistor as a flow measuring device. Particular attention is given to the various calibration curves that are obtained when the thermistor is connected to different basic electrical measurement circuits. Values for physical quantities given are for the specific thermistors tested; however, the concepts shown should be generally valid.

In Chapter I, a relationship expressing the heat transfer from the thermistor to the water is established. Physical quantities are measured by conventional means with the exception of the thermistor temperature. The temperature of the thermistor is found by comparing its electrical pulse impedance when it is heated by d c power and subjected to flow with its pulse impedance when it is immersed in static water at known temperatures. The pulses used are of short duration and occur at a frequency low enough so that they cannot cause the thermistor temperature to rise above the water temperature. The relationship which expresses the heat transfer from the thermistor to the water is then formed by correlating the data through the use of dimensionless ratio equations.

In Chapter II, this relationship is used to construct a graphical model of the thermistor velocity meter. From this model, various calibration curves are formed. The errors to be expected with each are discussed.

Chapter III describes the measurement of point-by-point velocities of a flow situation in a hydraulic flume.

The first appendix is a manual for those who wish to use thermistors to measure flow, without major concern as to the origin of the response curves. The second appendix reviews other methods of flow measurement.

This study has had three significant results. The

first is the acquirement of an overall understanding of the thermistor as a flow measuring device. The second is a description of basic measurement circuits and their manner of use. The third is a suggestion of a method of study of other thermal indicators for the measurement of velocity in various fluids.

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A TRAVELING-WAVE ELECTRON DEFLECTION SYSTEM

(Publication No. 5798)

Richard Churchill Honey, Ph.D.
Stanford University, 1953

A detailed study is made of a particular type of slow-wave structure whose transverse electric fields may be utilized for deflecting an electron stream. This structure consists of a single wire line over a plane folded back on itself repeatedly, and descriptively called a zig-zag line. It is a special case of parallel zig-zag lines in that it does not propagate a mode whose transverse electric fields are zero along the plane of symmetry.

The phase velocity of such lines as a function of frequency is determined both theoretically and experimentally for a wide range of geometries, and curves are shown which indicate the effects of changing each pertinent dimension, keeping other factors constant. The theoretical approach utilizes a lump-loaded transmission line as an equivalent circuit for the zig-zag line. Mutual coupling between adjacent sections of the transmission line is included, as well as lumped inductances replacing the sharp bends in the line. The agreement with the experimentally measured curves is good, particularly at the lower frequencies, and the analysis indicates which factors are chiefly responsible for certain characteristics, such as the dispersion, the high frequency cut-off, and the low frequency phase velocity asymptote. It is then possible to alter those particular factors to arrive at a desired result.

A theoretical analysis of the interaction of electrons with purely transverse fields is included which takes into account the deflection occuring within the deflection space as well as within the drift space. A general family of curves is plotted to indicate the results of this analysis for various ratios of drift space length to deflection space length. The results are then applied to traveling-wave structures, and the electron velocities are determined which produce the maximum deflection as a function of frequency, phase velocity, and geometry of structure and drift space. In addition, the perturbing effects of any reflected waves are evaluated.

A tube utilizing a zig-zag line deflection structure nine inches in length was built and its phase velocity carefully measured from 100 mc to 2700 mc. The tube was placed on a demountable vacuum system and a small electron beam was directed along the structure between the line and the plane — its deflection being measured on a fluorescent screen. The tube exhibited a maximum sensitivity of over 1 mm total deflection for an input power 20 db below a milliwatt. This deflection sensitivity is also discussed from several theoretical viewpoints and the results agree substantially with the measured results. The impedance of such a structure can be found as a function of frequency from the above measurements using the results of the equivalent circuit analysis. A matching section tapering from coaxial line to line-over-plane transmission line is also described in some detail.

The possibilities of using these structures in conjunction with special collector plates and external circuits to build a wide band, high sensitivity spectrum analyzer are discussed.

In addition, these tubes, with larger beam currents, exhibit substantial gain and may be used as amplifiers or oscillators. The gain parameter is calculated approximately for the particular tube tested here and found to be relatively large compared to usual traveling-wave tube gain parameters. Experimentally measured points of maximum gain and oscillation, voltage vs frequency, are plotted alongside the measured phase velocity curve to show the relationship.

It is concluded that such zig-zag line structures, in either the form of a line over a plane or of parallel lines, show primise for use in traveling-wave deflection devices.

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AN INVESTIGATION OF POLYPHASE TO SINGLE-PHASE TRANSFORMATION

(Publication No. 5483)

Kenneth Eugene Lindley, Ph.D.
State University of Iowa, 1953

The stator of an induction motion or synchronous motor a symmetrical three-phase winding and drawing balanced sinusoidal three-phase current produces a magnetic field that is constant in instantaneous magnitude and moves around the air gap at a velocity in proportion to the frequency. If on this stator there is a second winding, identical to the first and drawing identical currents but of the opposite phase sequence, it will also produce a revolving field. This field will be moving in the opposite direction to that of the first winding due to the difference in phase sequence of the currents. The summation of the two fields is a pulsating field which will change sinusoidally with respect to time and always be directed along a specific axis. This dissertation is an investigation of the possibility of using this pulsating field to excite a coil from which single phase power could be drawn from the three-phase power.

In the laboratory observations balanced line voltages are used which, due to the nature of the action of the fields, result in unbalanced line cirrents. A unique method of using two three-phase generators to supply a balanced three-phase voltage under unbalanced currents is devised. The line currents of each phase are in time phase with the corresponding coil currents. Each line current equally divides to the correponding coils of a phase. The result is a pulsating field occuring along a specific axis and changing sinusoidally with respect to time.

Thorough mathematical and graphical solutions of the resulting field and its components are developed. The simplest relationship for the maximum magnitude of the field and the time phase relationship of the resultant field is

$$M_R = N\,I_A \cos 15 \angle a + N\,I_B \cos 105 \angle b + N\,I_C \cos 135 \angle c$$

In this N is a constant relating the effective currents to the field. The 15, 105, and 135 are the angles between the respective phase coils' positive axes and the resultant field axis. The I_A, I_B, and I_C are the line currents. The a, b, and c are the time phase angles of the line currents. The field occurs along a specific axis and may be expressed in respect to this axis with magnitude and direction as

$$\overline{M_R} = M_R \sin (wt-m)$$

In this m is the angle that the field lags the time reference of the currents.

The exciting currents are unbalanced due to the phase displacement of the phase voltages and the physical displacements of the coil axes from the resulting field axis. If a current is flowing in the secondary, it has different effect upon the phase currents of the primary due to the coil displacements. The time phase angle of the secondary current will also change the effect upon the primary currents. These relationships all contribute to unbalance in the phase powers of the primary. Due to this unbalance of the currents and the phase powers, the apparatus has limited practical applications at present.

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TCHEBYCHEFF RC FILTERS

(Publication No. 5729)

Charles Bruce Sharpe, Ph.D.
University of Michigan, 1953

The principal result of this paper is the derivation of a general rational function of best approximation to zero in the Tchebycheff sense. This function is a generalization of the more familiar Tchebycheff polynomials. Using this function filters are obtained which have a Tchebycheff, low-pass characteristic. The poles of the corresponding transfer functions are arbitrary, and their number exceeds the number of zeros in the finite p-plane by one. The maximum deviation of the frequency response in the pass-band can be specified in the design procedure given.

The rational function of best approximation to zero has other useful applications in the design of filters. In particular, it is shown how this function can be used to obtain Tchebycheff low-pass filters having specified points of infinite attenuation.

An optimum criterion is presented for filters having no points of infinite attenuation at a finite frequency. With this criterion, which is based on a filter gain parameter, it is shown that any transfer function having no zeros in the finite p-plane which is a Tchebycheff function of best approximation to a constant is the transfer function of an optimum filter. The optimum filter criterion reduces to the familiar criterion of maximum gain-bandwidth product as a special case.

For purposes of illustration two RC Tchebycheff filters are synthesized. A 2-pole coupling network is designed which gives a noticeable improvement in the gain per stage over the conventional parallel RC interstage network.

In the Appendix it is shown for the class of RC filters considered that maximum gain is obtained when the poles of the transfer function merge into a single, multiple order pole on the negative real axis. Using this result, an upper bound is determined for the gain of any Tchebycheff RC low-pass filter for which the number of poles exceeds the number of zeros in the finite p-plane by one.

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RADIO INTERFERENCE FROM CORONA DISCHARGES

(Publication No. 5816)

Robert Leigh Tanner, Ph.D.
Stanford University, 1953

Corona discharges are studied, with special attention given to the mechanisms by which they produce electromagnetic disturbances which cause interference with radio reception. The means by which these disturbances are coupled into the receiver, and the nature of the dependence of this coupling upon the geometrical configuration of the body on which the discharge occurs, are examined. The theory thus developed is applied to the problem of precipitation static as it occurs in aircraft.

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ENGINEERING, MECHANICAL

CONSISTENCY IN RATING METHOD AND SPEED OF INDUSTRIAL OPERATIONS BY A GROUP OF TIME-STUDY MEN WITH SIMILAR TRAINING

(Publication No. 5647)

Robert Gordon Carson, Jr., Ph.D.
University of Michigan, 1953

This study is to determine the degree of accuracy and consistency attained by a group of time-study men in rating changes in speed and motion path. The time-study men who participated were trained to rate alike and were familiar with the operations rated.

The men studied worked for a company which conducted a one-hour rating session each week. Film loops of industrial operations were shown and rated at four projector speeds. The ratings made on the films were compared after each film loop. Selections from the records of ratings made by six men over a period of six years were studied. Statistical methods were used to determine the accuracy and consistency of the speed ratings.

The effect of method in the results was investigated by an analysis of the ratings made by ten men on sixteen motion-picture films of two simple arm-and-hand motions. These films were rated weekly for six consecutive weeks. They depicted movements between two fixed points, at a constant speed, but with different motion paths. Film loops in which the motion path remained constant and the speed of movements in feet per minute changed, were used as controls. Four of the men who participated in this experiment were among the six whose records of past rating sessions were analyzed.

The results of the study of past rating sessions showed that these men did not differ significantly from each other in the level of their ratings or in standard deviations. The standard deviation of single independent ratings was 6.67 percent. The standard deviation of ratings of motion path changes did not differ significantly from the above, but the level of the ratings was about 9 percent higher. The level of rating can be corrected if the rater is aware of the direction and extent of his bias.

A more limited study compared ratings made during the time study on the floor of the shop with ratings made by the same man on a film loop of the same operation. The results are inconclusive. A brief check was also made on the relationship between the ability of a time-study man to judge the comparative length of time intervals and his ability to rate film loops. This study is also inconclusive.

The major conclusions of the studies are:

1. A group of time-study men, trained alike in evaluating speed of work, will rate film loops alike. The level of the ratings and the standard deviations will not be significantly different from each other.
2. The standard deviation of independent ratings made by well-trained men is 6.67 percent.
3. Men trained to rate speed of operation and speed changes can also rate changes in the motion path of simple hand-and-arm motions.

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A STUDY OF THE INJECTION REFRIGERATION CYCLE AS APPLIED TO A NOVEL TYPE COMPRESSOR

(Publication No. 5648)

Willis Merle Carter, Ph.D.
University of Michigan, 1953

The purpose of this study is to evaluate the performance characteristics of a novel type refrigeration compressor and to determine if the injection cycle will improve the coefficient of performance with this particular compressor. The importance of the coefficient of performance is due to its relation to the operating cost of a regrigeration system, and any means of improving this coefficient would be worthwhile. The novel compressor used in this study eliminates the principle disadvantage of the injection cycle, that being the possibility of damaging the compressor, due to the injection of the liquid regrigerant directly into the cylinder.

Chapter I deals with the theoretical aspects of refrigeration. A discussion of the factors affecting the coefficient of performance is given and equations for calculating this coefficient for the injection cycle are developed. A summary is presented of the numerical calculations of the coefficients of performance for three refrigerants, Freon 12, Ammonia and Methyl Chloride, when operating on the vapor cycle, the wet-compression cycle and the injection cycle. A definite increase in the coefficient of performance with the injection cycle is shown.

Chapter II contains a description of the novel compressor. This is essentially a rotary piston compressor, inherently balanced, which can be run at high speeds. An absence of valves of the conventional type permits good volumetric efficiency. In Chapter III, the test setup is described and in Chapter IV, experimental results are given.

Several conclusions can be drawn from this study. (1) The compressor operates satisfactorily. (2) The injection cycle theoretically increases the coefficient of performance. (3) A slight gain in the coefficient of performance is actually obtained with the injection cycle when using the novel compressor. (4) Increased gains could be made by properly sealing and designing the injection nozzles. (5) The compressor is not damaged by excessive amounts of liquid regrigerant injected into the cylinder.

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A STUDY OF THE THERMODYNAMIC IRREVERSIBILITY IN A FLUID EXPANDING BEHIND A MOVING PISTON

(Publication No. 5934)

Ralph M. Rotty, Ph.D.
Michigan State College, 1953

In this study, the concept of entropy production is fundamental. The rate at which entropy is produced is a direct measure of the irreversibility of a process. In order to determine the energy degraded during a given process, it is necessary simply to integrate with respect to time the product of the rate of entropy production and the absolute temperature.

The first major hurdle in such a determination is the development of an analytical expression for the rate of entropy production. For the case of a viscous fluid, it has been found convenient to use a fluid dynamics approach. Beginning with the statement of Newton's Second Law and the equation of continuity, it is shown that the rate of energy degradation in an element of a viscous fluid is given by:

$$\rho T \theta = -\frac{\vec{q}}{T} \cdot \nabla T + (\Omega_{ij} \cdot \nabla) \cdot \vec{V}$$

where: θ = rate of entropy production per unit mass

T = absolute temperature

ρ = fluid density

$\vec{q}$ = rate of heat flow into the fluid element

Ω_{ij} = viscous stress tensor

$\vec{V}$ = velocity of the fluid element

For the case of a fluid expanding in the cylinder of an engine, the terms on the right hand side of the equation were simplified by taking averages of velocity and temperature in cylindrical fluid elements. The equation was then reduced to

$$\rho T \theta = \frac{k}{T} \left(\frac{dT^2}{dx}\right) + \frac{h}{T} \frac{(T - T_S)^2}{f_c} + \frac{4}{3} \mu \left(\frac{dV}{dx}\right)^2$$

The term, $\frac{k}{T} \left(\frac{dT}{dx}\right)^2$, represents the rate of energy degradation in a unit volume of fluid as a result of heat exchanges with other fluid elements. This is called the α_1 effect. The term, $\frac{h}{T} \frac{(T - T_S)^2}{f_c}$, represents the rate of energy degradation as a result of heat exchanges between the fluid and the cylinder walls, and is called the α_2 effect. The final term, $\frac{4}{3} \mu \left(\frac{dV}{dx}\right)^2$, called the β effect, is the energy degradation as a result of the viscous forces.

The procedure required in the evaluation of these terms was demonstrated on the old Russell Steam Engine in the Power Laboratory. The engine was modified to run on compressed air rather than steam, and the fluid (air) volume in the cylinder was divided into seven elemental volumes. Pressures and temperatures were measured instantaneously at many points within the expanding air by employing a system of sliding brass tubes which passed through the cylinder head and piston. Forty gauge thermocouple wire was used in the measurement of temperature and an SR-4 strain gauge mounted on a thin diaphragm was used to measure pressure. The physical measurement of some quantities supplemented by reasonable estimations of others, made possible the calculation of α_1, α_2, and β effects. Data are presented on each effect with the Russell Engine running at 60, 120, 180, and 240 revolutions per minute.

In the case of reciprocating engines the α_2 effect is by far the largest. Variation of β with engine speed is shown to be linear, while α_1 and α_2 although increasing with speed in this range may not continue to do so at still higher speeds because of shorter time duration for the flow of heat.

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THE STABILITY OF LIQUID FREE SURFACES

(Publication No. 5745)

Mehmet Rasin Tek, Ph.D.
University of Michigan, 1953

The purpose of this investigation was to study the behavior of liquid free surfaces under the action of a gas phase medium immediately above the common interface.

The mechanics of excitation behavior and growth of surface waves was considered both for ideal and real fluids. The mathematical analysis of the perfect fluid flow case led to interesting results which were studied graphically. The real fluid problem was solved by using energy considerations. The mathematical background of generalized surface equations of viscous fluid motion was reviewed with special reference to the "Wind Tide" effect that was observed during the experimental stage of the work.

The results of the analytical investigations of part I were subjected to the test of comparison with experimental measurements. Reasonable and good agreement was found to exist between the mathematical predictions and the observed variations.

The experimental phase of the work also resulted in the design and development of two simple, satisfactory methods: one for generating waves of any desired amplitude or wavelength, the second for accurately measuring the amplitudes of the surface waves.

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SOLAR ENERGY AS A POTENTIAL HEAT SOURCE FOR THE HEAT PUMP

(Publication No. 5566)

James LeRoy Threlkeld, Ph.D.
University of Minnesota, 1953

The thesis is an analytical investigation of the potentiality of solar energy as a heat source for the heat pump with emphasis on domestic applications. The study covers four broad classifications: (1) availability of solar energy in the Unites States, (2) energy demand for heating and cooling of residences in the United States, (3) methods of complete or partial utilization of solar energy for house heating, and (4) a study of the design and characteristics of the components required in solar energy-heat pump systems.

Results of extensive calculations showing distribution of solar radiation available in the United States on variously oriented surfaces are presented for the cases of outside the earth's atmosphere, at the earth's surface during cloudless days, and at the earth's surface during all days. Included are discussions of the earth's position relative to the sun, the solar constant, and depletion of radiation by the atmosphere. Extensive analyses of Weather Bureau records for Blue Hill, Massachusetts; Madison, Wisconsin; Lincoln, Nebraska; Nashville, Tennessee; and New Orleans, Louisiana are presented.

Results of extensive calculations on the energy demand for heating and cooling of residences in the United States are presented. It is shown that the design heating load of a particular house varies widely with geographical position but that the design cooling load is approximately uniform. It is shown that for most localities in the United States, a larger capacity heat pump is needed for winter heating than for summer cooling.

Analyses of various vapor compression heat pump cycles are presented for the cases of constant temperature heat source and constant temperature heat sink and for constant temperature heat source and variable temperature heat sink. It is shown that the ordinary single-stage vapor compression system is desirable if the source and sink have constant temperatures but that a system using multiple condensers and flash chambers is desirable for a variable temperature heat sink. It is shown that Freon-11 is the best refrigerant from a thermodynamic standpoint when compared to eight other common vapor refrigerants.

A rational method is presented for estimating the daily efficiency of a flat-plate type solar energy collector. The efficiencies calculated by this method are indicative of maximum efficiencies which may be expected in an actual collector. It is shown that a solar energy-heat pump system in the northern half of the country should use a collector with two glass panes, while a system in the southern half should use a collector with one glass pane.

An extensive engineering analysis is presented concerning the design of solar energy-heat pump systems for four localities. A rational design procedure is presented for estimating collector area, heat storage volume, heat pump specifications, and auxiliary heating capacity. It is shown that the collector area and heat storage volume should be determined for the average winter, and not for the worst year on record with auxiliary heating required during unfavorable years. The heat storage facility should be placed on the evaporator side of the heat pump in preference to the condenser side. It is shown that in many localities in the country a solar energy-heat pump system may require components of moderate size. Analyses show that actual heat pump coefficients of performance of five or more may be realized, and that operating costs of solar energy-heat pump systems may be considerably less than those of fuel-fired systems in many localities.

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ENGINEERING, MECHANICS

TORSION AND TENSION OF A PRETWISTED BAR

(Publication No. 5808)

Allan Gordon Norem, Ph.D.
Stanford University, 1953

The solution for the problem of torsion of straight uniform bars by couples applied at the ends was given by Saint-Venant. No exact solution has yet been found for the problem of torsion of pretwisted bars by couples applied at the ends.

An intuitive approach to this latter problem indicates that the torsional rigidity is always increased by pretwist. This change in torsional rigidity may be regarded as a correction dependent upon the pretwist. For a given degree of pretwist, the correction terms are more significant for slender sections than for thicker ones.

Ōkubo has developed a solution for the problem of torsion of a pretwisted bar of arbitrary cross section, for the case of small pretwist. His solution has so far been applied only to bars of elliptical cross section, and its application to other sections appears to present considerable difficulty. For a pretwisted bar of elliptical cross section, Ōkubo's approximations are such that he finds the shearing stresses τ_{xz} and τ_{yz}, and hence the torsional rigidity, unaffected by the pretwist. However, he is able to find expressions for the normal stresses σ_x, σ_y, σ_z and for the shearing stress τ_{xy}, all of which are proportional to the pretwist.

For slender sections it is possible to simplify the problem by using series approximations. With no loss of generality we relate the pretwist of the bar to the slenderness, thus expressing these two

small quantities by a single parameter which we may call the slenderness-pretwist parameter. We then expand the displacements and the stresses in series in powers of this parameter. Solving for the coefficients in this series, we are able to build up, term by term, the solution for the displacements and for the stresses. This method is applied in the thesis not only to bars of elliptical cross section, but also to bars of arbitrary singly-symmetric section. It has not yet been applied to bars of completely general unsymmetrical section. For a pretwisted bar of elliptical cross section this method of solution shows that the shearing stresses τ_{xz} and τ_{yz} are affected by pretwist, and verifies the increase in torsional rigidity predicted by the intuitive approach. In addition, the solution gives us higher order pretwist terms which become important for large pretwist, and which are absent in Ōkubo's solution because of the nature of his approximations.

An intuitive approach to the problem of tension of a pretwisted bar indicates that the extensional stiffness is always reduced by pretwist.

Ōkubo has developed a solution for a bar of arbitrary cross section, having small pretwist. As before, his solution has so far been applied only to bars of elliptical cross section. He finds that the extensional stiffness of the bar is reduced by pretwist, as predicted by the intuitive approach. In addition, he finds that the tensile load in the z-direction sets up normal stresses σ_x, σ_y, shearing stresses τ_{xy}, τ_{xz}, and τ_{yz}, and gives rise to a twisting deformation of the bar.

The method of expansions of the displacements and the stresses in series in powers of the slenderness-pretwist parameter has been applied in the thesis to this problem for bars of arbitrary singly symmetric section. For an elliptical cross section this method yields a solution which verifies the results of the intuitive approach and the results of Ōkubo. In addition, this method gives us higher order pretwist correction terms which are absent in Ōkubo's solution due to his restriction to small pretwist.

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SHELLS OF NEGATIVE CURVATURE

(Publication No. 5810)

Rex Edward Paulsen, Ph.D.
Stanford University, 1953

The stress analysis of shell structures ordinarily proceeds in three steps. First, the membrane forces are determined from the membrane theory equations. The corresponding displacements of the shell and its supports are then evaluated. The second step is to repair the discrepancies between support and edge displacements as well as possible with inextensional deformations. Lastly, the remaining incompatibilities in the deformations are reconciled by use of a bending theory analysis. The latter step amounts to analyzing the localized effect of small edge disturbances. There is some question as to whether this method of analysis is applicable to shells of negative curvature since the membrane theory of such shells reveals unexpected discontinuities in the stresses. This thesis is intended as a contribution to the answer.

Chapter II deals with the membrane theory. In the introductory section, the general equations are examined. They are combined to yield one second order partial differential equation; for shells of negative curvature, this equation is shown to be of the hyperbolic type. Consequently, it is suspected that edge disturbances will propagate along the characteristic lines of the surface into the shell's interior without diminishing appreciably.

In the following sections, solutions are given for the membrane stresses in the hyperboloid of one sheet, two-frustum conical shells, and multi-frustum conical shells. For the two latter shells, attention is given to the formulation of juncture relations and the necessity for stiffening rings. The use of a multi-frustum conical shell to approximate any shell of revolution is illustrated with several numerical examples. Exact and approximate solutions are compared.

The final section of Chapter II considers configurations which are critical with respect to certain combinations of edge loads. Criteria are evolved which determine the critical configurations of the two-frustum conical shell and the hyperboloid of one sheet. The correspondence between the two sets of criteria is discussed.

Inextensional deformations are considered in Chapter III for the purpose of gaining physical insight into the critical configurations. The two shells treated in the membrane theory chapter are analyzed. It is found that by assigning edge displacements in certain combinations, the same criteria are obtained which determine the critical membrane theory configurations. A simple physical interpretation of this correspondence is given.

In order to scrutinize the earlier results in the light of a more powerful theory, the exact bending theory is used for analyzing a thin two-frustum conical shell with a critical shape; the applied loads are those which the membrane theory will not admit. For comparison, three other shells are analyzed: (1) the non-critical thin shell, (2) the critical thick shell, (3) the non-critical thick shell. Curves are presented for four stress resultants and one displacement in each shell. It is found that the bending theory results for the critical and non-critical shells are remarkably similar. The behavior of the stresses at the juncture is found to influence the results to an unexpected degree.

In the Appendix, the derivation of Nollau's exact bending theory solution for the tapered-wall cone is presented. This solution was used for the numerical work of Chapter IV. Several errors were found and rectified, and some of Nollau's simplifying assumptions were avoided. The whole treatment was

made in a set of coordinates consistent with that of Chapter II.

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THE EFFECT OF SPECIMEN SIZE ON THE BEGINNING OF YIELDING IN MILD STEEL

(Publication No. 5813)

Cedric W. Richards, Ph.D.
Stanford University, 1953

The effect of specimen size on the strength of materials is a factor which has often been neglected, but one which is becoming recognized as of great importance in many cases. This is brought out in the study of such problems as the much debated raised yield point in bending of mild steel, and the variations noted in the strength of brittle materials. In the former the greater part of the disagreement between investigators appears to be due to differences in the sizes used for experimental beams. In the latter a basis for understanding has been developed by Griffith, Weibull and others in the form of statistical theories, which establish the influence of size as the controlling factor.

The foundations of the statistical theories are the concept of the existence of flaws of various kinds distributed at random in all materials, and the "theory of the weakest link," according to which it is the worst flaw among all the flaws in a given specimen that determines its strength. Since a large specimen may be expected to have worse flaws than a small one the effect of size is at once apparent.

The part played by flaws in initiating yielding in mild steel is similar to that which they play in brittle fracture. The mechanism of yielding may be represented by a model consisting of brittle and soft components. Such a model is in accordance with both experimental observations and accepted theories. In this model, the beginning of yielding coincides with the rupture of the brittle component. Consequently the laws governing the beginning of yielding are the same as those governing brittle fracture.

As a result of the application of statistical theory to the beginning of yielding a relation is obtained between the volume of a specimen and its upper yield point strength. The latter is found to vary inversely as the volume raised to the power 1/m, where m is a material constant. This relation applies to any stress distribution — tension, bending, torsion and so forth — but with different factors of proportionality.

Using the particular relations for simple tension and pure bending it is possible to express the ratio between the stresses at the beginning of yielding in the two cases. For the usual values of the material constant, m, this ratio is found to be very nearly one, indicating only a small increase due to the non-uniform stress distribution in bending. The important outcome of the theory is, then, the discovery of a relation between specimen size and the beginning of yielding.

Support for the theory is found in the experimental investigation. The first series of tests covers the case of simple tension. Unusual care is required in this type of testing because of the susceptibility of the upper yield point of mild steel to factors such as eccentricity, speed of loading and shape of specimen. Using suitable precautions the influence of these factors is minimized. The results of the experiments show close agreement between the average yield strength for each size tested and that predicted by the statistical theory. The second series of tests covers the case of pure bending. Here, too, the trend of results is in accordance with the predictions of the theory.

The final conclusion is that in experimental investigations involving the yielding of mild steel the factor of size is one which must be reckoned among the important variables.

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STEADY STATE MOTION OF ONE AND TWO DEGREES OF FREEDOM VIBRATING SYSTEMS WITH A NONLINEAR RESTORING FORCE

(Publication No. 5728)

Patarasp Rustomji Sethna, Ph.D.
University of Michigan, 1953

The motions of vibrating systems with one and two degrees of freedom with a nonlinear restoring force are studied. The study is limited to steady state motions under the influence of external excitations that vary sinusoidally with time.

The nonlinear restoring force is of the form

$$ky + h|y|^{n-1}y$$

where y is the deflection of the spring, k and h are positive constants and n can be any positive number. The detailed discussion is restricted to the case n = 3 except in one case where the case n = 2 is considered. The ratio $\frac{h}{k}$ is not restricted to numbers very much less than one.

In the first chapter the method of approximation is discussed. It assumes that the steady state solution has the same period as the external excitation and thus can be represented as a Fourier Series. To obtain the N-th approximation to the solution the first N terms of the Fourier Series are substituted in the differential equation and N simultaneous polynomial expressions in their coefficients are obtained. These expressions which relate the amplitude of the harmonics with the frequency of external excitation are called Response Equations. A rigorous

mathematical justification for the method employed is not attempted. The adequacy of the method is merely demonstrated by comparing the results obtained by it with those obtained from an Electronic Analog Computer for specific values of the parameters.

In the first chapter is included the first and second approximation to the solution of Duffing's Equation.

In the second and third chapters are obtained the first approximations to the response equations for the undamped case and damped case respectively, of a two degrees of freedom system. The response equations are discussed for all physically possible values of the parameters.

The thesis ends with three Appendices and a Bibliography. Appendix I deals with the free motion for a one degree of freedom system for all positive values of n in the restoring force. Appendix II discusses method of solution by the Electronic Analog Computer and Appendix III discusses briefly questions of stability.

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THE REPRODUCTION OF AN ARBITRARY FUNCTION OF TIME BY DISCONTINUOUS CONTROL

(Publication No. 5821)

William Stuart Wunch, Ph.D.
Stanford University, 1953

With the growth of mass production techniques, scientific experimentation, and modern warfare, a demand for automatic control devices has developed to yield a uniform quantity and/or quality performance not otherwise possible or to perform particular operations under conditions adverse to human existence. It becomes necessary to study the behavior of these devices to be able to understand the possibilities of any particular system.

In this analysis no specific quantity is to be controlled, but rather studies are made of a single degree of freedom system which will identically reproduce command input functions despite circuit impedances. This circuit is idealized to the extent of being able to cope with the problem mathematically; for example, the basic reproductive system is assumed to be governed by a linear differential equation:

$$a^*y_o'' + b^*y_o' + cy_o = y_i(t) \qquad (1)$$

The solution of equation (1) describes the response $y_o(t)$ to the command $y_i(t)$. Usually the coefficients a*, b*, and c*, representing the effective mass, damping, and spring coefficients, respectively, are assumed constant. It may readily be shown that the resulting solution y_o does not give a satisfactory response to the command function y_i. By a suitable variation of the coefficients b* and c* (which describe circuit impedances), it will be shown to be possible to have the output duplicate the arbitrary input. These arbitrary functions are limited to those found in the physical world; mathematical discontinuities are eliminated from consideration at the outset.

The discontinuous variation of the coefficients b* anc c* according to the equations

$$b = b^* + |\Delta b_1| \operatorname{sgn}\{y_o'(y_o - y_i)\} + |\Delta b_2| \operatorname{sgn}\{y_o'(y_o' - y_i')\} \qquad (2)$$

$$c = c^* + |\Delta c_1| \operatorname{sgn}\{y_o(y_o - y_i)\} + |\Delta c_2| \operatorname{sgn}\{y_o(y_o' - y_i')\} \qquad (3)$$

can reproduce arbitrary functions exceedingly well, the error of reproduction depending upon the magnitudes of the discontinuous coefficients as well as the initial deviation. It is to be observed that as with other automatic controls information on the performance of the output relative to the input is fed into the controlling coefficients.

Throughout the dissertation it is assumed that the duplicator operates exactly according to the mathematical laws presented. In reality many factors exist such as variable time lag, dry friction, etc., which are not considered here; it is obvious that these effects must be minimized for the success of the project. By assuming the output is very close to the input, the mathematical treatment of this problem is considerably simplified. In this event the input y_i may be replaced by y_o, thereby permitting the resulting homogeneous differential equations to be solved in the phase plane for all arbitrary functions. This assumption is shown to be valid in regions where the error is much smaller than either the input or output.

Several examples illustrating the operation of this mechanism are given. In the absence of a machine, methods are cited giving a simple graphical procedure to illustrate the phase technique of reproduction. A large improvement of the reproduction due to the discontinuous variation of the damping and spring coefficients is shown. The limitations of this procedure are discussed.

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ENGINEERING, METALLURGY

SINTERING OF ULTRA-FINE FERROMAGNETIC POWDERS

(Publication No. 5825)

Narayana Iyer Ananthanarayanan, Ph.D.
Lehigh University, 1953

In this work an attempt has been made to study the sintering process from very much earlier stages than have previously been considered by studying the sintering behavior of ultra-fine iron powders having

various metallic iron contents. The equipment and techniques of handling these fine powders are described as also the techniques employed for testing powders and powder compacts. Ultra-fine iron powders have been prepared by the low temperature hydrogen reduction of ferric oxide as well as of ferrous formate with and without small additions of magnesium formate. A study of the particle size and shape as a function of reduction temperature of the ferric oxide by X-ray line broadening, nitrogen adsorption and electron microscopy, indicates particle sizes of the order of 200-250 A.U., and very nearly spherical shapes. A possible method of particle dispersion as well as alignment by the proper use of a magnetic field is described and discussed.

The magnetic properties of "loose" powders and powder compacts prepared from reduced ferric oxide yielded high coercive forces but only relatively low saturation and remanence on account of their high oxygen contents. The ultimate coercive force of these powders was found to increase with increased metallic iron content, a value of 860 oersteds being obtained for powders containing 60% metallic iron. Powders and powder compacts prepared from reduced formates showed not only high coercive forces, but relatively high saturation and remamence as well. Small additions of magnesium formate to the ferrous formate before reduction tend to appreciably increase the coercive force of the reduced powders and powder compacts without being detrimental to the saturation and remanence. Thus powders prepared from formates containing as little as 0.066% Mg showed a 25% increase of coercive force over that of powders from pure ferrous formate.

A study of the thermal sintering of compacts of powders from reduced rouge has been made in an attempt to evaluate the possible influence of sintering time, sintering temperature, purity of the powder and sintering atmospheres on the early stages of sintering. The magnetic properties, especially the coercive force of the compacts, have been used to observe the progress of sintering. It has been found that the coercive force versus sintering temperature curves may be considered to be made up of three parts, viz.,

(a) the initial part corresponding to a range of low temperatures up to 1000°- 1200° F, in which the coercive force decreases very slowly when the sintering atmosphere is reducing, but remains sensibly horizontal when the sintering atmosphere is inert,

(b) a second part corresponding to a relatively narrow range of sintering temperatures in which the coercive force undergoes a rapid diminution from initially high values of 400-500 oersteds to very low values of 50 oersteds and less, and

(c) a final portion corresponding to the highest temperatures used in which the coercive force again tends to decrease slowly.

These results are generally explicable on the basis of particle interaction leading to sintering of the metal particles and consequent formation of domain boundaries. The initial portion of the curve represents little or no particle interaction, whereas the second part corresponds to appreciably sintering and boundary formation. The third part of the curve begins at a stage where boundary formation has been completed and slow elimination of the porosity begins to take place. The variations in saturation and remanence values are also understood on the same basis.

While differences in the course of the curves due to the influence of the variables studied, viz., of sintering temperature, sintering time, pressure of compaction, sintering atmospheres and increased metallic iron content of the powder, may be observed, these differences are found to be relatively small.

Considered as a whole the results of this study have led to the belief that the very early stages of sintering are those that occur during powder preparation, whatever be the method of preparation employed and as such may not readily be observed. According to this, one may regard sintering to begin as a process of nucleation and growth, thus making the sintering process a complete analogue of the freezing of metals from the melt and of the subsequent processes involved in the fabrication of the solidified metals.

A preliminary study of the permanent magnet characteristics of compacted powder magnets from powders reduced from rouge has also been made and energy values of the order of 0.5×10^6 gauss-oersteds per c.c. have been obtained. The low energy value is found to be associated with relatively low saturation and remanence values and small fullness factors of the order of 30-35% in spite of fairly high coercive forces. The energy product maximum has been found to occur at approximately 60-65% metallic iron in the magnets, when compacts pressed at 60 t.s.i. from powders reduced in the temperature range of 600°—850° F are compared.

Microfilm copy of complete manuscript of 117 pages, $1.46. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1407.

AN INVESTIGATION OF THE ISOTHERMAL TEMPER EMBRITTLEMENT OF A 5140 STEEL

(Publication No. 5645)

Spencer Harrison Bush, Ph.D.
University of Michigan, 1953

Specimens from one heat of steel were embrittled at various temperatures and their response determined with impact tests, metallographically using both optical and electron microscopes, and by Meyer's numbers and X-ray lattice parameter measurements.

Isothermal levels of 750° F, 850° F, 950° F, and 1050° F for 1, 10, 24, 100, 1000, 3000, and 5000 hours were investigated as well as 1000° F for 1, 10, 24, and 100 hours and 1100° F for 10, 24, and 100 hours. Special tests consisted of the following cycles: 750° F - 100 hours, 1250° F - 1 hour; 950° F - 100 hours, 1250° F - 1 hour; 950° F - 100 hours, 1250° F - 1 hour, 950° F - 100 hours; and a 950° F - 100 hour

cycle for the steel after the austenitic grain size was coarsened. All specimens were tempered at 1275° F for 5 hours prior to embrittlement. Additional tests were conducted on the annealed steel in the as-received state, after a tempering treatment and after a 950° F - 100 hour embrittling cycle.

Two criteria were used to determine the transition temperatures of the steel: 50 ft-lb. impact energy, and 50 percent brittle fracture. The toughening treatment whether fine-grained, coarse-grained or in the annealed state was the base condition; transition temperature shifts determined the degree of temper embrittlement. Specimens at 750° F embrittled slightly in 5000 hours; at 850° F extreme and continued embrittlement occurred; at 950° F embrittlement was pronounced in 100 hours, then was unchanged or decreased slightly. Tests at 1050° F indicated two reversals, one short time, the other long time. Results at 1000° F and 1100° F confirmed these changes.

Reheating for a short time to a higher temperature after initial embrittlement eliminated this embrittlement; it recurred on reheating to the lower temperature.

Coarsening the austenitic grain size shifts the transition temperature upward, but does not change the degree of embrittlement.

The preceding conclusions were based on the impact energy and percent brittle fracture results, and were confirmed by the response to etching, shift in lattice parameter, and, qualitatively at least, by the change in Meyer's numbers.

In the specimens with a pearlitic microstructure, no transition temperature shift was observed, despite the etch attack in the as-received state and after the embrittling treatment, indicating that a metallographic procedure should not be the sole criterion of temper embrittlement.

A mechanism is proposed, based on the reversals due to both time and temperature, the shift from a trans to intergranular fracture, the increase in Meyer's numbers, decrease in lattice parameter, and attack of the austenitic grain boundaries observed on embrittlement. Two concurrent rate reactions are postulated consisting of the diffusion of both interstitial and substitutional constituents to the austenitic grain boundaries, their entrappment in areas of misfit, and on cooling strain results in these regions. Sufficient strain at the embrittling temperature is believed to release the entrapped particles, causing a reversal. Since the rates of diffusion and entrappment of interstitial and substitutional constituents are different, an embrittlement, reversal, and reembrittlement, followed by a reversal can be explained on the basis of the positioning of two rate curves.

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FINE ARTS

THE NEW STAGECRAFT: ITS RELATION TO EASEL PAINTING

(Publication No. 5817)

Mildred Annamarie Karch Taylor, Ph.D.
Stanford University, 1953

It is the purpose of this investigation to examine the relationship of stage decoration, known as the "new stagecraft," to easel painting during the period from 1885 to 1915.

The inquiry is initiated by a summary of the criticisms of stage decor during the nineteenth century to the time of Appia's first critical essay in 1895. The second chapter is a discussion of nineteenth century stage decor before Appia and Craig. Chapter three traces the evolution of easel painting into its development as modern easel painting. This is in preparation for the discussion of the relationship between modern easel painting and the new stagecraft.

In sections four, five, and six of the investigation, in the order named, are: a presentation of Adolphe Appia's theories of stage design, a discussion of Appia's designs showing their relation to easel painting, a statement of Gordon Craig's stage design theories, an analysis of Craig's designs through the medium of easel painting, a resume of the contributions of Hubert Herkomer to stage design, a recognition of the inter-relationship of the influences of Appia, Herkomer, and Craig in the origin of the new stagecraft, and the part played by Max Reinhardt and his designers in the growth of the new stagecraft.

These three sections also summarize the causes for revolt in stage design, the principles upon which the new stagecraft grew, a discussion of the relation of individual designers, who were the originators of the new stagecraft, to individual painters, who were originators of the modern movement in easel painting, and an indication of the general parallel pattern of art revolt which resulted in the new stagecraft in the theatre and the modern movement in easel painting.

Section six states the conclusions of the investigation.

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A COMPARATIVE STUDY OF THE FOLKTALES OF ENGLAND AND NORTH AMERICA

(Publication No. 5855)

Ernest W. Baughman, Ph.D.
Indiana University, 1953

This dissertation is an analysis of 10,766 variants of 709 types and 1051 motifs of American and English folktales. The purpose is to show what is included in the corpus of each country, to show the frequency of occurrence and the distribution of each tale, and to determine the relationship of the tales of the two countries.

The following findings seem to be significant:

1. Certain assumptions about the tale-telling traditions of England and America have been supported and some have not. The preference for short rather than long tales, the interest in local stories, and the interest in supernatural stories are all apparent in both countries. Not supported is the assumption that the religious tale has been noticeably neglected. The presumed scarcity of Märchen in both areas is difficult to generalize about.

2. We are certain that of the 225 types (individual tales listed in the Aarne-Thompson index, The Types of the Folk-Tale) found in England and America thirty percent have both English and American variants. It is probable that at least fifty percent of the types were brought to America from England.

3. Seven hundred and nine variants of 225 types are included in this study. This is a surprising number in the light of the general belief that the established types are comparatively rare in the two countries.

4. Equally surprising is the fact that 248 variants of 92 types of ordinary folktales are included in the study. Of these, 154 variants of 38 types are Märchen.

5. The general surmise of scholars about the preponderance of jokes and anecdotes over ordinary folktales has been borne out by the evidence.

6. Section X (Humor) contains almost as many variants as the whole English corpus of 3739 motif variants; and it accounts for over half of the American total (6263).

7. The tall tale (X900-1899) is an overwhelmingly American form.

8. Belief in and stories about the fairies are British rather than American phenomena.

9. In five sections of the motifs, more than forty percent of the motifs have both English and American variants: Sections G Ogres (76.47 percent), M Ordaining the Future (70.00 percent), E The Dead (58.53 percent), Q Rewards and Punishments (50.00 percent), and B Animals (42.85 percent).

10. Twenty-five percent of all the motifs are represented by both American and English variants. By excluding the tall tale and the fairy stories, one can raise the percentage in the remaining sections to thirty-four percent, but even this figure is not an impressive one; nor is it as striking as the possible fifty percent for the same comparison among the types. On the basis of the evidence, we must conclude that for the motifs (except in Sections G, M, E, Q and B) the evidence is disappointing for showing correspondence of tales in the two countries. Either we in America have taken many of our tales from countries other than England, or we have developed many new ones of our own; perhaps we have preserved and recorded in America a great many tales which once existed in England without being recorded. Probably each of these suppositions is valid, but not enough data can be compiled to determine any kind of proportion among the three possibilities.

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AARNE-THOMPSON TYPE 480 IN WORLD TRADITION, A COMPARATIVE FOLKTALE STUDY

(Publication No. 5875)

Warren E. Roberts, Ph.D.
Indiana University, 1953

The thesis a study of Aa-Th type 480, "The Spinning Woman by the Spring," a folktale that has an international circulation. Four hundred and forty versions of the story from all parts of the world except Oceania are assembled and analyzed. The analysis follows, with some slight modification, the Historic-Geographic method first used in the study of folktales by Finnish scholars. The analysis suggests that the original form of this tale was composed in the Near East, perhaps in Persia, at some time prior to 1000 A. D. From the Near East this original form spread to Northern Europe, Africa, and India. The diffusion to Northern Europe followed two routes: from the area between the Black and the Caspian Seas north to Germany and Scandinavia and from the Balkan Peninsula north to Sweden. In Northern Europe several distinct subtypes have evolved from the original form. In the Near East at some later date a new redaction of the tale arose which joined with the "Cinderella" story, Type 510A. This combination spread from the Near East west across Southern Europe until it reached the Iberian Peninsula and east across Southern Asia as far as Burma and the East Indies. The tale has also reached Japan, where it exists in two distinct forms; but the exact route of diffusion to Japan cannot be determined because we lack information from China.

Type 480 has reached the New World in several distinct forms from Northern Europe, Spain and Portugal, and Africa.

The analysis demonstrates further that the original form of Type 480, which is best retained in Northern Europe, probably conformed to the outline which follows. A mistreated stepdaughter is sent to get water and loses the container. She pursues it and comes upon a cow that asks to be milked, a fruit tree that asks to be shaken, and an oven that asks to have removed the loaves of bread with which it is filled. The girl performs these tasks and continues her journey until she comes to a house where an old woman hires her as a servant. The girl serves faithfully and, at the end of a period of time, is allowed to return to her home. As a reward for her services, the old woman permits the girl to choose between a large, attractive box and a small, ugly box. The girl chooses the small box which, when opened at home, is found to contain gold. The cow, the fruit tree, and the oven reward her as she passes them. The real daughter is envious and tries to imitate the stepdaughter. She refuses to help the cow, the tree, and the oven; she does her work poorly at the house of the old woman; and she chooses the large box as a reward. When she opens the box at home snakes come out and kill her and her mother.

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THE UPPER SUSQUEHANNA VALLEY, NEW YORK: A GEOGRAPHIC INTERPRETATION

(Publication No. 5839)

Eleanor E. Hanlon, Ph.D.
Clark University, 1953

This study is a descriptive interpretation of the geography of the Upper Susquehanna Valley, a typical segment of the hill and valley country of south-eastern New York State. The area studied is about 270 square miles. It occupies the central section of Otsego County.

The region drained by the headwaters of the Upper Susquehanna is hill country, intricately dissected by stream erosion; the molded contours of the uplands, the terraced sides and hummocky to flat-floored u-shaped valleys reveal the significance of recent glaciation of the area. The soils tend to be acid; their usefulness depends as much on how deep and well drained they are as upon differences in texture or structure. There is a fair degree of correlation between the terrain and the major soil characteristics. The rounded tops and upper slopes of the hills have a high proportion of shallow, poorly or imperfectly drained soils; the foot-hills, terraces and bottomlands have many areas of deep, well-drained soils. The upland areas are less intensively cultivated than those in the valleys; This is due in part to the inherent differences in soil depth and drainage. The climate of the region, with relatively cool, moist summers and long, severe winters, is adequate for pasture, hay, and most grains.

This area lies in a region with a long agricultural tradition. Yet, during the decade 1940-50 urban settlement accounted for approximately 70 percent of the population; of the remaining 30 per cent over half were part-time or non-farm rural residents. The urban concentrations occur, without exception, in the valleys, the largest ones being in the central and at the northern and southern ends of the Susquehanna Valley. An adequate network of roads serves all parts of the region.

The changing function of agriculture has been the prime force in shaping the present-day geography of the Upper Susquehanna.

Farming here has had at least four distinct stages of development. There was, first, the period of pioneer subsistence farming (approximately 1790 to 1820) during which the major tasks were centered upon clearing enough forest to provide room for basic food crops, a home and roads. Surplus wheat, potash, etc., were sold for cash. This was a period in which the Upper Susquehanna enjoyed a vital place in the country, a stopping place for cross-country travel.

The second period came with the opening of the Erie Canal, and the railroads. After 1825 the Susquehanna region lost its pre-eminence as a transportation focus. Cash crops, one by one, beginning with wheat, declined in competition with cheaper grains from the west. Two products achieved unusual importance for a short time: sheep, raised for wool, rose to national significance in the 1830's. Beginning about 1840, hops forged ahead to a position of national leadership.

While trial and error cash crops were attracting attention, farmers were steadily turning to products of the dairy. When the real upswing in demand for dairy products came in the late 1800's, the farmers of this region were ready. Thus the fourth period, viz.: the era of the dairy farm.

Today dairy farming is the dominant type of farming. Over 98% of the product is sold as fluid milk, chiefly to the New York City market.

Farms in the valley and uplands differ from one another chiefly in form and intensity of land use. The hill farms carry on a more extensive type of farming than those in the valley. In both sections the average size herd is the same.

Certain changes away from the dominance of dairying, are observable from maps showing changes in ownership and farm types. These are found concentrated chiefly around Oneonta and in Unadilla Town. In the rest of the area changes are slow to show, if they exist at all.

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PHYSIOGRAPHY OF THE BIG DELTA REGION, ALASKA

(Publication No. 5840)

Albert Havens Jackman, Ph.D.
Clark University, 1953

This study contributes data on drainage and glaciation in the Big Delta region which lies between the Alaska Range and the Tanana River. Big Delta enjoys a favored location, but has been neglected by previous Alaskan surveys in favor of sites of potential mineral wealth.

There are two important stages of old glaciation in the Delta region. An intervening period of undetermined duration is here referred to as Alaska Interglacial Time. The earlier and more extensive Delta Lobe Glaciation was of a piedmont type which extended from the mountains nearly to the Tanana River. The later or Valley Tongue Glaciation never achieved the proportions of the piedmont glaciation

and is illustrated in this region by five former valley glaciers of great size, (here designated as Granite, Ober, Delta, Trident, and Little Delta Tongues). In Post-Valley Tongue Time, sources of these glaciers disappeared or shrank to their present dimensions.

Various types of evidence distinguish the two old glaciations: relative position, orientation, and appearance of Delta Lobe and Valley Tongue Moraines; differences in sedimentation in kettle lakes of the two moraines; young and old glaciated surfaces, differences in degree of stream dissection on these surfaces, and differences in age of outwash deposits, and stream terraces. Maximum limits of the Delta Lobe Ice are more precisely marked along the northern and eastern margins than on the western. Delta Lobe glaciation appears to be a northern extension of a former Copper River-Susitna Ice Cap. The Valley Tongue glaciation is similar to and may correlate with a late stage of extensive valley glaciation reported in Southern Alaska, Yukon Territory, and British Columbia. Correlation of these two glaciations with glaciation elsewhere in the world is not yet possible, but there is evidence that glacier activity has been continuous since Valley Tongue Time.

A marked similarity between three stages of vegetation on terraces and terrace segments from valley to valley of the large glacier streams suggests a common influence regulating the late history of these streams. No explanation for this is known. Names descriptive of the stages of vegetative progression on these terraces have been assigned as follows: Spruce Terrace (pure stands of white spruce), Spruce-Poplar Terrace (lower terraces on which the white spruce has not yet crowded out balsam poplar), Cobble Terrace (the lowest system of terraces on which there are xerophytic grasses and lichens, but no trees).

Present glaciers are of three types: South Slope, North Slope, and glaciers in a fault valley along the axis of the Alaska Range. The South and North Slope types are counterparts of mountain glaciars all over the world, but glaciers of the fault valley are unique, and their like has not been reported elsewhere. This latter type is characterized by a long trunk fed by an extensive system or systems of tributaries. In all cases where these glaciers are now active or have been active in the recent past, they exhibit extremely contorted medial moraines near the terminus. Examples are found on the Yanert, Susitna, West Fork-Susitna, Black Rapids, and Gakona Glaciers. R. P. Sharp in discussing the Susitna moraines attributed the contortions to surge-like advances of tributaties. It is here suggested that these surge-like advances result from earth tremors causing avalanching into the source cirques, which in turn produces pulsations of increased activity along the tributaties and into the main ice stream.

Donnelly Dome is a lone mountain near Big Delta, of a type known as a tind, shaped by flowing ice. Horseshoe mountain is an unroofed anticline of Nenana Gravel on which Little Delta River has been superposed from a former ice border. Delta River taps an area of drainage anomalies in a region of Headwater Lakes and Basins south of the Alaska Range, drawing water to the Yukon that otherwise would flow normally to the Gulf of Alaska.

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TOWSON: A GEOGRAPHIC SURVEY OF AN URBAN COMMUNITY

(Publication No. 5843)

Oliver Herman Laine, Ph.D.
Clark University, 1953

Towson, one of ten suburban community areas surrounding the city of Baltimore, Maryland, is experiencing severe "growing pains." Within the Baltimore Region, Towson assumes major significance because: (1) It is the county seat which gives it importance as a focal point that is perhaps not equalled by any other community; (2) it is the second largest suburban community within the urban complex; (3) it is the third most important industrial area within the highly industrialized Baltimore Region; and (4) it lies on the northern perimeter of Baltimore City, the direction in which most of the residential and industrial expansion from this highly industrialized area must and will take place.

In other respects, too, Towson stands out as one of the leading communities in the Baltimore Region. Its commerce is rapidly developing. Even though its industrial position is high, its residences, somewhat paradoxically, are generally of the highest quality, as are its residents in terms of income and general status. However, Towson's eminent position seems to be somewhat of a hindrance to healthy growth of a future pattern. The growth of its population in the last quarter century, especially during the past seven years, has all but inundated the landscape. Towson has grown from a "sleepy, country town" of about 7,000 population in 1920 into a veritable metropolis of about 37,000 in 1953.

This sudden influx of humanity found the community totally unprepared for it and, although it is learning to handle the situation, it remains to be seen whether fast enough to prevent ultimate deterioration of its presently strong base. Rapid change with its attendant problems characterize every aspect of community activity. Public utilities which were adequate in the recent past, have hardly kept pace with expanding residential development. Socially, the "old guard" vociferously deplores the invasion of their hallowed ground, but their cries are rapidly being drowned out by the din of the lungy bellows of the ubiquitous children and the ringing of hammers around the new dwellings that spring up, literally overnight.

Increased governmental activities, by virtue of Towson's role as the county seat, and the shift from regional to local employment have caused concern for highways and public transportation serving Towson and the Baltimore Region. Increasing numbers

of industrial and governmental workers and the resultant demand for lower priced housing is causing great concern for safeguarding the health and welfare of the community, particularly because of the sharp rise in the number of row-house developments whose rather high densities are jeopardizing the equitable distribution of existing sewer capacities. In addition, rowhouses are creating conditions of overcrowding which has been found to be the major factor in slum development in Baltimore City. Furthermore, social apathy has caused certain non-white slums to add blight to an otherwise progressive community pattern.

Commercially, Towson is in a state of dynamic growth. Off-street parking is a primary concern, especially in the older areas, if this growth is to enhance the residential and industrial functions of the community.

Industrially, Towson is in a favorable position. The predominance of skilled labor in the industrial activity has tended to keep Towson in its eminent residential position. And, even though the unique political make-up of Towson and all other communities in the Baltimore Region precludes the need for any certain percentage of industrial establishments to maintain a healthy tax base, there are other advantages of local industry which should be recognized so that sites will be provided for additional development, which will insure the diversity necessary to maintain a strong community base.

All of the above factors are manifestations of the change which has characterized Towson in the recent past, a change which will continue for some time to come. If recognized and properly appraised, and willingly and intelligently met by all concerned, Towson's future position can be every bit as eminent as now, perhaps even more so.

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PHASES IN THE DEVELOPMENT OF THE LAND-WATER RESOURCE IN AN IRRIGATED RIVER VALLEY, COLORADO

(Publication No. 5903)

Manuel John Loeffler, Ph.D.
University of Washington, 1953

The development of the land-water resource is a salient aspect of the geography of the Western United States. Artificially applied water that supplements and replaces the scant and variable precipitation has occupied the minds of Anglo-Americans for over a century. Near-barren land where warm-season rainfall permits of extensive agriculture and livestock raising has been transformed into areas of intensive agriculture that provide a stable economy with a high standard of living for a substantial part of the total population. In this transformation five distinct, yet inseparable, phases of land development evolve to form an orderly progression. These phases, and the problems that inhere, are clearly exemplified in the Pueblo-Holly sector of the Arkansas Valley in Southeastern Colorado.

Phase One is characterized by the Individual Ditch as an adjustment to geographic conditions. It has implications that extend beyond the mere physical labor of carrying water to riverside land with small, crudely constructed ditches. The Individual Ditch opened a new frontier for settlement. Applying water to the land increased its productivity thereby providing a stable habitat in the "Great American Desert."

In Phase Two the development of irrigation was impeded by legal principles. Rules that governed the use of water under the English Common Law needed remolding into a set of laws that were in harmony with geographic conditions. In an amazingly short time, a body of irrigation laws was created that served as a guide in the development of land not only in the Pueblo-Holly sector, but in all irrigated areas of the Western United States.

The decision by the courts that the single, most important element associated with water is its beneficial use by mankind instigated Phase Three of the progression. Cooperative effort was encouraged and irrigation companies and irrigation districts were formed to develop the land under the new philosophy of research utilization. Large quantities of water were diverted, and in twenty years the irrigated area of the Pueblo-Holly sector was developed essentially to its present extent.

Procurement of ever-increasing quantities of supplemental water is peculiar to Phase Four. A large volume of water flows down the Arkansas River during the spring months and during flood periods. Reservoirs were built to impound the unused water for use when there is little direct stream discharge. Water has become such a valuable commodity that private interests diverted it from Western Slope areas across the Continental Divide to Eastern Slope reservoirs.

The distinguishing feature of Phase Five is the entry of the Federal Government into land reclamation. The John Martin Reservoir was built to supply additional water and to provide a basis for the amicable settlement of an interstate water controversy. The proposed Gunnison-Arkansas Project is designed to tap unappropriated water resources in the Colorado River Basin. Plans for diverting this water to the Pueblo-Holly sector have stimulated sectionalism anew and strong opposition prevails in several areas.

The people of the Pueblo-Holly sector think of transmountain diversion as the solution to the existing water problem. Although unappropriated water exists it will soon be awarded to the several interests striving to secure a share. After this water has been taken, the people will focus their attention on the obstacles that prohibit the effective use of the present water supply.

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PYROMETASOMATIC ORE DEPOSITS AT JOHNSON CAMP, ARIZONA

(Publication No. 5780)

Arthur Baker III, Ph.D.
Stanford University, 1953

Pyrometasomatic copper-zinc mineralization is in Paleozoic rocks ranging in age from Cambrian to Pennsylvanian, but all except one of the commercial orebodies are in the Middle member of the Cambrian Abrigo formation. The scope of this paper is restricted to these orebodies and to metamorphic rocks associated with them. The only igneous rock exposed in the district is a single lamprophyre dike.

The Paleozoic sediments lie in a monocline striking northwest and dipping about 40° northeast. The bedding plane surfaces of the monocline are warped by two sets of shallow folds, one set trending about due east, the other set trending N 10° W. There are three sets of faults, one set striking easterly and dipping south, another set striking N 20° E and dipping steeply east, and the third set striking N 10° W and dipping steeply either east or west. All five of these sets of structure developed nearly simultaneously, but it has not been possible to demonstrate that any two sets are genetically related. All the structures were formed before the metamorphism and mineralization, but fault movement continued until after these processes were completed.

There are two types of metamorphic rocks: white tactite, a diopside-quartz-orthoclase rock, and garnetite, a grossularite-diopside-quartz-orthoclase rock. The white tactite was formed from the impure dolomites of the Upper member of the Cambrian Abrigo formation and the lower half of the Devonian Martin formation. The garnetite was formed from the limestones of the Lower and Middle members of the Abrigo formation. The white tactite is uniformly distributed throughout the impure dolomites, but most of the garnetite is restricted to well-defined shoots lying in the crests of folds in the uppermost 50' of the Middle Abrigo member. Both the garnetite and white tactite have about the same chemical composition as their parent sediments, except that they do not contain CO_2. Some loss of volume resulted from the expulsion of CO_2 during the metamorphism.

The orebodies are broad thin lenses lying in the uppermost parts of garnetite bodies; in many cases the orebodies conform closely in shape to the outline of the garnetite shoots. In thin section, the sulfides are inwardly younger than the metamorphic minerals, but on a larger scale, the orebodies are inwardly associated with garnetite masses.

The only abundant sulfides are chalcopyrite and sphalerite; locally pyrite is common. Scattered grains of magnetite, hematite, molybdenite and scheelite are also found in most of the ore. All of the sphalerite contains numerous minute blebs of chalcopyrite; the size and pattern of these blebs changes progressively along the length of individual orebodies, and also from orebody to orebody. A temperature-controlled replacement of sphalerite by chalcopyrite is postulated to account for the progressive changes.

Both the metamorphic rocks and the ore were formed during a single period of solution activity, but the rocks were formed during an early phase, and the ore during the latter phase. There was some overlap between the two phases. During the earliest phase, no new material was added to the rocks, but during the mineralization phase, large amounts of sulfides were added. The main channels of solution flow were the shattered zones along fold axes in the Middle Abrigo member; faults rarely acted as solution channels. There were no well-defined channels in the dolomites, but these rocks were permeable enough to admit the early solutions, which altered them thoroughly.

Microfilm copy of complete manuscript of 125 pages, $1.56. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1416.

MESOZOIC STRATIGRAPHY AND STRUCTURAL HISTORY OF THE EAST TEXAS BASIN

(Publication No. 5782)

Thomas Davies Barrow, Ph.D.
Stanford University, 1953

This report is a study of the Mesozoic stratigraphy and structural history of the East Texas Basin and the relationship of part of this history to the accumulation of petroleum. It is based upon an examination of electric logs, sample descriptions, sample logs, drillers' logs, and available paleontological information from both cores and rotary samples.

The term "stage" has been substituted for the term "group" for the time-rock subdivisions of the Comanchean and Gulfian Series of the Cretaceous System. The generally recognized time-rock subdivisions have been adopted as regional stages, and the boundaries have been tentatively defined by paleontological zones which have been described by previous workers.

The structural development of the East Texas Basin has been studied by means of a series of isopachous maps, paleogeologic maps, and one lithofacies map. The interpretation of structural movements from isopachous maps is based on the concept that if a sequence of rocks is deposited on a flat surface and is warped either during deposition or before a younger horizontal surface is developed, variations in the thickness of the rocks between the two surfaces and the

character of the surfaces mapped will reveal the amount and place of deformation.

Five periods of erosion and associated structural movement are known to have taken place during the Cretaceous: at the beginning of the Gulfian Epoch, at the beginning of the Eaglefordian Age of the Gulfian Epoch, at the beginning of the Austinian Age of the Gulfian Epoch, at the beginning of the Taylor an Stage of the Gulfian Epoch, and at the beginning of the Tertiary Period. Structural movements, however, were limited to these known erosian intervals, and in fact the structural movements which took place during the Trinitian Age of the Comanchean Epoch are unrelated to any unconformity.

The Mexia-Talco fault zone has been active intermittently since Lower Trinitian time. Earlier movement along this fault zone is impossible to determine because of a lack of data.

The Sabine uplift changed from a slightly negative area to a positive area at the beginning of the Gulfian Epoch and has remained a slightly positive structural area almost continuously to the Recent. Movement on the Rodessa fault on the northern flank of the Sabine uplift first occurred during the Fredericksburgian Age of the Comanchean Epoch and continued throughout the remainder of the Cretaceous Period. The Mount Enterprise fault zone had minor movements in Fredericksburgian time, but the first major movement took place during the Washitan Age of the Comanchean Epoch. Movement has continued intermittently along this fault zone from the close of Comanchean time to the Recent.

The Tyler basin began to form as a sedimentary basin as early as Lower Trinitian time. Minor domal and anticlinal structures in the area have had periods of growth and periods of structural quiescence, and only a few minor anticlinal trend existed during the Cretaceous. Neither the amount nor the time of movement of either of these structures or the local basins developed within the Tyler basin is possible to predict. No genetic relationship can be shown to exist between these local basins and the known shallow piercement type salt domes.

The accumulation of oil and gas in the Woodbine formation in the East Texas Basin can be related in part to early structural growth and the resultant early traps. However, the producing fields and the adequately tested nonproducing structures cannot be directly correlated to the time of formation of the trap. Factors not evident on a lithofacies map nor on an isopachous map must be partly responsible for the absence of the accumulation of petroleum on some of the nonproducing structures.

Studies of the accumulation of petroleum in the Eagle Ford and the Paluxy formations of the Cretaceous substantiate the fact that the accumulation of petroleum within any one horizon is not completely controlled by the time of formation of the trap.

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THE PETROGRAPHY OF THE MARIANA LIMESTONE, TINIAN, MARIANA ISLANDS

(Publication No. 5786)

Harold W. Burke, Ph.D.
Stanford University, 1953

The Mariana limestone is a Pliocene- or Pleistocene-to-Recent coral reef-complex of the Pacific-type which forms 80 percent of the terrain of Tinian Island. Tinian, with an area of 42 square miles and a maximum elevation of 620 feet, is the third largest of the Mariana Islands, which are the sub-aerial expression of the Mariana Arc, one of the series of island arcs bordering the Pacific Basin on the West.

Mapping of the Mariana limestone was carried out in 1950 by a United States Geological Survey party on the assumption that it was deposited under conditions similar to those around a modern coral reef-complex. The seven facies mapped are thought to be approximately correlative with facies of modern Pacific-type complexes. Megascopic criteria are not sufficient, in small samples, to differentiate either the facies mapped or the deposits of the off-reef, reef, and lagoonal environments. Facies, some of which are diagnostic of environment, are mapped on characteristics apparent only in mass. Environmental origin was assigned to a deposit on the basis of (1) its geographic and topographic relationship to raised reefs and other diagnostic facies, and (2) the type and attitude of its bedding.

Microscopic and chemical analysis of one hundred samples of Mariana limestone were carried out at Stanford University during 1951 and 1952. The sand-sized bioclastic fraction was studied at a magnification of 32 diameters by counting all bioclasts as to type and size along traverses of large thin-sections. This fraction was chosen for study because (1) its grain-size probably best reflects the currents normally present around a reef-complex, (2) the bilclasts can be readily identified with respect to organic type, and (3) the source of the bioclasts is known. The bioclasts were divided into eight groups: coral, Bryozoa, lithothamnium, Halimeda, Foraminifera, Mollusca, echinoids, and miscellaneous. These were studied with regard to variation with environment by (1) measuring the percentage of each organism present in the sand-size fraction; (2) comparing the percentage composition of each size class of the fraction; (3) determining parameters of size-sorting; (4) determining the relationship of (1), (2), and (3) to distance from reef; and (5) comparing the relationship between size-sorting and percentages of organisms present. Eighteen samples were studied spectographically to determine the amounts of impurities. Dolomite content was tested by staining one hundred samples in copper-nitrate solution.

The core of the island consists of two upthrown fault blocks of late Eocene pyroclastic andesite and early Miocene (Aquitanian) coral limestone. The Mariana limestone was deposited as the island emerged during late Pliocene, Pleistocene and Recent times. Distribution of reefs and the other diagnostic facies indicate that the Mariana limestone was

deposited by the same major processes as are operative around modern reef-complexes. Reef and lagoonal deposits of early Mariana deposition were removed by planation at lower levels of the sea, but the corresponding off-reef deposits form the mass of the Mariana limestone. They have been blanketed by lagoonal and reef deposits formed at lower levels of the sea.

The results of the textural-ecologic study of the sand-sized bioclastic fraction can be best explained by postulating the same processes that occur around modern reef-complexes; that is, (1) most organisms live in two or more of the environments, (2) currents vary both spatially and temporally within each environment, and (3) several paths are available for transportation of most bioclasts from source to site of deposition. Although some variation with environment occurs in most characteristics tested, parameters involving Halimeda show the least overlapping, probably because (1) its growth is restricted largely to the lagoon, and (2) fewer routes are available for transportation of its detritus. An excellent segregation of off-reef and lagoonal samples was demonstrated by the relationship between the sorting of the Halimeda, the percentage of Halimeda in the sand-sized fraction and the environment.

Chemical analysis showed that magnesium content is not related to lithothamnium content but that active dolomitization by volume-to-volume replacement is occurring in a sub-aerial zone enveloped by sea spray. Aragonite is rare and is restricted to bioclasts.

Microfilm copy of complete manuscript of 164 pages, $2.05. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1418.

STRATIGRAPHIC ANALYSIS OF UPPER DEVONIAN AND MISSISSIPPIAN ROCKS IN THE MICHIGAN BASIN

(Publication No. 5699)

Duncan Junior McGregor, Ph.D.
University of Michigan, 1953

Most of the Michigan Basin is covered by a mantle of glacial drift and only in a few places is bedrock exposed. Thus Upper Devonian and Mississippian rocks must be analyzed by subsurface methods.

An analysis of a large stratigraphic interval such as the Upper Devonian and Mississippian does not present a clear geologic history. Therefore, the total interval is subdivided into smaller operational rock units (A, B, and C) which are recognized on the basis of lithology.

Isopach and lithofacies maps serve as a basis for interpreting sedimentation processes, tectonics, and environmental conditions. The sand-shale ratio and carbonate and evaporite percentages were used in the statistical analysis.

Interpretation of isopach and lithofacies patterns show (1) gradation from mildly unstable shelf to intracratonic basin associations, (2) the epeirogenic disturbances in the basin and source areas greatly influenced sedimentation in the basin, (3) subsidence was the principal epeirogenic disturbance in the basin and the presence of gentle arches within the basin was largely the result of differential subsidence rather than uplift, (4) the local environmental differences are primarily a result of differences in depth of the sea floor and restriction of circulation, and the irregularities on the sea floor are principally of tectonic origin, (5) carbonate deposition is probably the result of chemical and/or organic precipitation but may be, in some cases, mostly clastic, (6) carbonate rocks and evaporites appear to be controlled by structural conditions because maximum thickness takes place in the structural lows, and (7) epeirogenic disturbances were not localized in any one area during the deposition of Upper Devonian and Mississippian sediments but shifted with time.

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THE STRATIGRAPHY AND STRATIGRAPHIC PALEONTOLOGY OF THE UPPER MIDDLE ORDOVICIAN ROCKS OF FILLMORE COUNTY, MINNESOTA

(Publication No. 5569)

Malcolm Pickett Weiss, Ph.D.
University of Minnesota, 1953

This report re-evaluates the stratigraphy of the Middle Ordovician rocks that lie between the Glenwood and Maquoketa formations in southeastern Minnesota. The stratigraphic classification used distinguishes rock units without respect to faunal zones. The Glenwood beds are excluded from the Plattsville formation and are considered as a separate formation above the St. Peter.

The Plattsville formation consists of carbonate rocks lying between the shales, sandy shales, and sandstones of the Glenwood and the green calcareous shales of the Decorah formation. It consists, from the base upward, of the Pecatonica light brownish gray dolomitic limestone (thinning to a feather edge toward the northwest), the McGregor yellowish gray, thin-bedded, crinkly-bedded, microgranular limestone, and the Fillmore pale yellowish brown, medium bedded, very fine-grained limestone with some brown shale interbeds and a prominant bentonite bed near the base. The Fillmore member is new, and occupies the same stratigraphic position as does the Quimbys Mill member in Wisconsin.

The Decorah formation consists of greenish gray calcareous shales with some coquinoid limestone layers in the lower and upper parts. It is not separable into members and thins toward the southeast.

The top is marked by a concentration of Prasopora sp. in the beds transitional from the shale to the limestone. A bentonite bed near the base converges toward the Fillmore bentonite in the southeastward.

The Galena formation consists, from the base upward, of the following members: Cummingsville yellowish gray, microgranular, argillaceous limestone with alternating intervals of limestone that give a serrated profile to weathered outcrops and contains some chert nodule horizons toward the southeast; Prosser yellowish gray, microgranular limestone (restricted from previous usages) with numerous streaks and lenses of silty coquinoid rock and many chert nodule horizons that become more numerous and prominent toward the southeast; Stewartville pale yellowish orange, fine grained dolomitic limestone that contains less insoluable material than any of the other units studied. The Stewartville appears heavy-bedded because the thin beds are grouped into thick units that are separated by prominent shaly bedding planes.

The Dubuque formation consists of even beds of light olive gray limestone with interbeds of light olive gray calcareous shale. Its top is marked by a transition to yellow dolomitic limestone with the detrital fraction evenly distributed throughout the rocks.

Special features noted are as follows: (1) diastemic corrosion zones in the Pecatomica, McGregor, Cummingsville and Prosser members; (2) southeastwardly converging bentonite beds in the Fillmore member and Decorah formation (the upper one is correlated with the Spechts Ferry bentonite of Iowa); (3) "brassy colites" that occur in the middle and topmost parts of the Decorah toward the northwest.

The chert nodules of the Galena formation are interpreted as secondary chert formed as a peripheral feature of the mineralization of the Wisconsin-Illinois mining district. The feldspathized shale beds of the Stewartville and Dubuque are thin beds, predominantly of authigenic orthoclase, that are interpreted as having been formed by the alteration of bentonite by ground water.

All the lithologic contacts are gradational, as are all the faunal changes. There is a gradual succession of faunal elements from bottom to top. The Dubuque is considered to be late Middle Ordovician in age, principally because of the greater similarity of its brachipod fauna to that of the Prosser than to that of the Maquoketa. An extensive faunal list accompanies the report. A few species are illustrated and commented upon critically.

The following five faunal zones are discussed: (1) Vellamo zone of the Cummingsville and lower and middle Prosser; (2) lower Receptaculities zone of the Cummingsville; (3) upper Receptaculities zone of the lower Stewartville; (4) zone of holothurian (?) tubes in the upper Stewartville; and (5) Ischadites iowensis zone of the middle Prosser.

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HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

PARKINSONISM

(Publication No. 5554)

Sidney Keith Shapiro, Ph.D.
University of Minnesota, 1953

A review of the literature on Parkinsonism is presented including a discussion on the historical aspects, clinicopathologic data and animal experimentation, pathogenesis, tremor and rigidity, electromyography, drug therapy, psycho-therapy, physical therapy and surgery in Parkinsonism.

Four patients with classical Parkinsonism were subjected to a total of thirteen studies in which the elastometer was used. The results of elastometry in Parkinsonism are too variable to allow this to be used in assessing drug therapy. The physical state of the muscles in Parkinsonism as measured by the elastometer varies from time to time and there is no constant relationship to the clinical condition of the patient. It is possible clinically to have a definite increase in rigidity while the muscle actually has become softer as measured by the ballistic elastometry. The condition of the patient under laboratory conditions did not necessarily reflect the condition of the patient as he functions in his environment.

A series of seventeen electromyographic tracings were done on nine patients with Parkinsonism. Six had slight or no variations in electromyographic activity. In one patient, the electromyographic activity during the control period was extremely variable. In one patient, the activity was of such slight magnitude that he was unsuitable for the assessment of intravenous therapy. One patient showed constant electromyographic activity in the laboratory on one occasion while on another occasion, she had extreme variability. Intravenous artane, intravenous atropine, intravenous sodium amytal, and occlusion of the venous and arterial circulation caused a decrease in electromyographic activity in the patients studied. If a medication for Parkinsonism is present in both oral and intravenous forms, the influence of the intravenous preparation on the electromyographic activity might

give some index as to whether the oral form could be expected to produce any benefit. It is doubtful, however, if this method could be applied to the assessment of drug therapy in Parkinsonism except in a very limited manner. The artificial conditions of the laboratory and the potential dangers of intravenous administration militate against its widespread usage even in the instances where the new drug is available in both oral and intravenous forms.

A clinical method for assessing drug therapy in Parkinsonism was devised. All drugs to be assessed in the treatment of Parkinsonism are delivered to the dispensary without ever having been seen by the doctor who is to conduct the study. Here numbers are signed to the drug and to a placebo. The key to the identity of the drug is not disclosed until the final assessment of the drugs is made at the end of a six-month period. One physician prescribes numbered compounds to alternate patients and he alone sees these patients during the period of study. A minimum of twenty cases is necessary for the study of a single new drug. 10 receiving the placebo and 10 the active compound. By this method, the objectivity of the examiner is assured. In addition the effect of the new drug can be compared with that of the placebo as well as with the previous medications the patient has received. The psychological factors in assessing drug therapy in Parkinsonism are important. Three patients while receiving placebos achieved objective evidence of improvement for a period of one to four months. No single drug or a combination of drugs is "best" for the treatment of Parkinsonism. Nine different combinations were necessary to achieve the best therapeutic results in 24 of the 28 patients studied. In the remaining four patients, three achieved equally good results from two or more medications. The objective clinical picture of the fourth patient was not helped by any of the medications employed.

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HEALTH SCIENCES, HYGIENE

HEALTH EDUCATION SUBJECT-MATTER AS PREFERRED BY PROFESSIONAL AND LAY PEOPLE IN MONTANA

(Publication No. 5768)

Max Edmond Kimberly, Ed.D.
Stanford University, 1953

The objective of this study was to ascertain from three Montana health-informed groups their health subject-matter preferences in the training of secondary and college students. Through personal interviews with 16 health education specialists from secondary schools, colleges, and governmental agencies in Montana the selection of various sub-groups of medical, teacher and lay personnel were made from a check-list. The groups selected were composed of health-informed people who were participating in various phases of school and community health programs. The people selected from the medical profession were called the medical group; the people selected from the teaching profession were called the teacher group; and the lay persons selected were called the lay group.

The Byrd "Major Health Problem Area" list was used as an instrument to secure opinions regarding health problems that the various groups thought should be included in the educational curriculum. This list of 21 major health area classifications contained an original 300 subdivisions consisting of specific health problems of varying significance. The 300 health problems were selected from the subject-matter of more than 10,000 scientific and public health articles appearing in medical, public health, and allied scientific journals from 1942 to 1948. A five-digit scale (ranging from 0 to 4 and representing from NO EMPHASIS to MAJOR EMPHASIS) was devised to score each specific health problem.

A total of 1,585 Health Subject-matter Survey Forms were distributed in this study to the three groups. The 787 returns represent a response of 49.7 percent. Personal interviews were made with numerous representatives of each participating group.

In the analysis of the data each group had a mean of 2.25 on the 299 health problem preference scores.[1] The health problem preference correlations among the groups range from .87 to .90. Nineteen health problems received total group scores of 3.00 and above. This indicates that the content of 19 health problems was judged worthy of "considerable emphasis" in the training of secondary school and college students. Health problems worthy of "considerable emphasis" are shown in the following table.

HEALTH PROBLEMS IN THE "CONSIDERABLE EMPHASIS" CLASSIFICATION

Health Problem	Total Group Mean	Total Group Percentile
Speed and accidents	3.34	100
Lifelong care of the eyes	3.27	100
Major health problems	3.23	100
Drunken driving	3.19	99
Good posture	3.17	99
School health program	3.15	99
Problems of dental decay	3.13	98
Causes of mental illness	3.11	98
Traffic accidents	3.11	98
Preparation for marriage	3.08	97
Problems of alcohol	3.07	97
Cancer	3.07	97
Immunization in children	3.05	96
Accidents as a national problem	3.03	96
Poliomyelitis	3.03	96

Sewage disposal	3.02	95
Safety in the water	3.02	95
Juvenile delinquency	3.01	95
Safety in the home	3.00	94

There were 213 health problems receiving scores equivalent to and exceeding the "average emphasis" classification.

Major health area preference correlations among the three groups ranged from .80 to .93. SAFETY was ranked first by each individual group. The first ten broad areas were ranked in the following order: (1) SAFETY, (2) HABIT FORMING SUBSTANCES, (3) CHRONIC AND DEGENERATIVE DISORDERS, (4) HEALTH AS A SOCIAL ACCOMPLISHMENT, (5) COMMUNITY HEALTH SERVICES, (6) NUTRITION AND HEALTH, (7) FAMILY HEALTH, (8) SCIENTIFIC HEALTH SERVICES AND FACILITIES, (9) SCHOOL HEALTH, (10) MENTAL HEALTH AND DISEASE.

There were minor variations in the rank-order of health problems contained in the health areas as evidenced by the range of correlation coefficients from .58 to .99 among the groups.

Since Montana adult groups well-informed in health preferred an "average emphasis" on 213 health problems, and since there was agreement as to the importance of specific health problems and major health areas among the groups, it was concluded that this information could serve as a partial base for a curriculum building program in health education in Montana secondary schools and colleges.

1. By error there was a duplication of Pneumonia and Influenza in the list used in this study and an omission of one of the original 300 items.

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HEALTH SCIENCES, MEDICINE AND SURGERY

NON-SIMULTANEOUS BILATERAL BREAST CANCER

(Publication No. 5539)

Thomas Brannon Hubbard, Jr., Ph.D.
University of Minnesota, 1952

This subject has been investigated in order to decide whether routine prophylactic removal of the opposite breast is indicated in all patients who have a cancer of one breast.

Such prophylactic removal of the opposite breast was performed on sixteen patients with known unilateral cancer. The breasts were examined carefully, in ten cases the whole cross-section of the breast being examined microscopically at 1.0 centimeter intervals or less. In two of the sixteen cases, minute, unsuspected cancers were found in the opposite breast.

Two hundred sixty-four patients with unilateral cancer were followed, either to death or for a minimum of 9 years. 3.4 per cent developed non-simultaneous cancer in the opposite breast. This incidence was comparable to other series in the literature, the latter being reviewed thoroughly. Comparison with the population at large showed an increased risk when the first cancer developed before the age of 50 years, but not if it developed after 50 years of age.

Twenty-six consecutive cases of bilateral breast cancer were analysed in detail. No unique characteristics were found in regard to location of the tumors, alillary node involvement, sexual history, tumor type, or benign breast pathology.

There is some strongly suggestive evidence that pregnancy after a single breast cancer predisposes to cancer in the remaining breast.

Patients with bilateral cancer appear to have a significantly greater number of mothers and sisters with breast cancer than do those with unilateral cancer.

From the above total findings it is concluded that prophylactic removal of the opposite breast should be done only in those patients with unilateral cancer who (1) have a family history of breast cancer or (2) are premenopausal and desire to become pregnant.

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HEALTH SCIENCES, NURSING

THE CRITICAL INCIDENT TECHNIQUE IN IDENTIFYING BEHAVIORAL CRITERIA OF PROFESSIONAL NURSING EFFECTIVENESS

(Publication No. 5776)

June G. Teig, Ed.D.
Stanford University, 1953

Current problems in the selection, education, and evaluation of the professional nurse strongly indicate the need for a more adequate criterion measure in terms of the kinds of behavior the professional, graduate, staff nurse ought to have. Although the literature contains lists of abilities and qualities needed by the professional nurse, these lists tend to be ambiguous and intuitively derived.

The present study is concerned with identifying behavioral criteria of professional nursing effectiveness and investigating the extent to which nursing supervisors, patients, and doctors vary in their judgments relative to nursing effectiveness. The Critical Incident Technique was used to obtain the data.

Partially structured interviews were scheduled with professional personnel and patients in three types of hospitals in Northern California — a county hospital, a private hospital, and a university teaching hospital. All of the nursing supervisors and doctors who were available on the days the interviews were scheduled were asked to participate, however, patients in all three hospitals, of necessity, were sampled purposively from the men's and women's medical and surgical departments. The doctors and patients were interviewed on an individual basis; whereas nursing supervisors in two of the hospitals were interviewed in small groups of four or six. Resource personnel were asked to describe the most recent incident in which they observed the graduate, professional, staff nurse do something which illustrated effectiveness or ineffectiveness, these contrasting behaviors identifying the behavioral criteria of nursing effectiveness.

From the 187 interviews, 419 incidents were obtained, 108 from nursing supervisors, 180 from patients, and 131 from doctors. An analysis of the incidents by a process known as Category Formulation defined the following seven major aspects of the professional, graduate, staff nurse's job:

I. Demonstrating Manipulative Skill and Technical Competence.

II. Demonstrating Effective Organization of Work Habits.

III. Performing Effectively in an Emergency or Stress Situation.

IV. Providing the Patient with Emotional Support.

V. Demonstrating Effective Interpersonal Relations with Co-workers and Visitors.

VI. Maintaining Personal Appearance and Voice Control.

VII. Demonstrating Professionally Ethical Behavior.

Nursing supervisors most frequently reported incidents related to Area I, "Demonstrating Manipulative Skill and Technical Competence"; doctors were concerned with behaviors classified in Area III, "Performing Effectively in an Emergency or Stress Situation"; and patient reports were most often related to Area IV, "Providing the Patient with Emotional Support." Of the total 419 behaviors reported by all three resource groups, the largest number of incidents were related to Area IV. Thirty-one per cent of all incidents were classified in this area.

From a final analysis of all behaviors which were responsible for effective as well as ineffective performance of an aspect of the professional, graduate, staff nurse's job, twenty-seven behavioral criteria of nursing effectiveness were defined. Resource personnel demonstrated agreement on only two of the twenty-seven behaviors, "Giving medications and treatments on time," and "Talking about subjects of interest to the patient."

It would appear that behavioral criteria of professional nursing effectiveness vary according to the sources of judgment, and that if one is willing to accept the judgments of nursing supervisors, patients, and doctors then the criteria identified in this study will be meaningful.

Although the importance of manipulative skill and technical competence has been recognized and supported by nursing educators for many years, it would seem that the data in this study suggests other aspects of the professional, graduate, staff nurse's job which should be re-evaluated. "Providing the Patient with Emotional Support" which contained 30 per cent of all the critical behaviors, and 31 per cent of all behaviors reported by nursing supervisors, doctors, and patients supports non-technical behaviors which are critical to nursing effectiveness and would seem to provide information for further study.

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HEALTH SCIENCES, PATHOLOGY

PHOSPHOROUS METABOLISM OF THE BRAIN

(Publication No. 5525)

Maynard M. Cohen, Ph.D.
University of Minnesota, 1953

Phosphorous is essential for nervous system structure as well as function. This element is concerned in carbohydrate metabolism through phosphorylation and dephosphorylation of intermediate compounds. Phosphorylated coenzymes and high energy phosphates are employed in the process. The high energy compounds also supply energy needed for cerebral function, nerve conduction, and the synthesis of a number of substances including acetyl choline and polypeptides. Intravenous administration or topical application of high energy phosphates to nervous tissue results in physiologic alterations. Phosphorous is concerned with the structural aspects of the nervous system through its inclusion in phospholipid. The major portion of nervous tissue phosphorous is present in this fraction. Nucleic acids also contain phosphorous as an essential constituent, thus implicating this element in growth, various synthetic processes and heredity.

Incorporation of radioactive phosphorous into the brain from the blood stream is slower than the incorporation into other organs, presumably consequent to the "blood brain barrier". Rapid exchange occurs between the cerebrospinal fluid and the nervous system. Magnesium, potassium, sodium, and calcium are all directly concerned with phosphorous metabolism in brain and other tissues.

Quantitative alterations in the phosphorylated compounds of the brain have been reported in a variety of pathological and physiological states.

A study of inorganic, acid soluble, lipid, ribo- and desoxyribonucleic acid, and total phosphorous in humans in 73 post mortem and 21 surgical specimens revealed a close correlation between the phosphorous content and the histologic changes within the nervous system. The acid soluble and inorganic phosphorous was an indication of the number of functioning cells, while lipid phosphorous indicated the state of myelination. Ribo- and desoxyribonucleic acid phosphorous was a measure of cellularity as well as the relative amounts of nuclear and cytoplasmic nucleic acids. The ratio of ribonucleic to desoxyribonucleic acid phosphorous was one of the most sensitive chemical indicators of pathologic tissue alteration.

Necrosis in tumors as well as in non neoplastic cerebral tissue produced a diminution in all phosphorous fractions, particularly in acid soluble phosphorous. Desoxyribonucleic acid phosphorous was the last to disappear. In neoplasms lipid phosphorous diminished in proportion to myelin alteration, while nucleic acid phosphorous increase paralleled increased cellularity. In leukemia the presence of large numbers of white blood cells intravascularly was sufficient to produce an increase in cerebral nucleic acid content. Demyelination consequent to multiple sclerosis or other conditions presented essentially similar alterations manifested by diminution of lipid phosphorous in the histologically involved area. Nucleic acid phosphorous was changed only in the presence of glial changes. Marked arteriosclerosis results in demyelination sufficient to produce a significant decrease in cerebral lipid phosphorous.

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THE PATHOGENESIS OF HEPATIC NECROBACILLOSIS IN BEEF CATTLE

(Publication No. 5541)

Rue L. Jensen, Ph.D.
University of Minnesota, 1953

To obtain information on the pathogenesis of hepatic necrobacillosis of cattle, four phases of the disease were studied:

1) The relation of lesions of the stomachs to abscesses of the liver, 2) experimental rumenitis, 3) experimental production of liver abscesses, and 4) immunization against experimental liver abscesses.

Livers, rumina, reticula, and abomasa of 1,535 adult fat cattle were studied. Livers were examined for abscesses, the rumina and reticula for injury and inflamation, and the abomasa for erosions and ulcers. Histopathologic sections were made of all gastric lesions.

On the basis of gross and microscopic changes, lesions were classified as: rumenitis, hyperkeratosis of the rumen, and discontinuity of the mucosa of the abomasum. Of all animals examined, 37.6% contained rumenitis and an additional 5.5% contained traumatic reticulitis. Nontraumatic rumenitis was in acute and chronic stages. Acute rumenitis grossly showed necrosis, devillation, edema, gas, hyperemia, and hemorrhage; microscopically it showed vesicles, necrosis, edema, acute inflammation, and penetration of dead tissue by bacteria, including Spherophorus necrophorus. Chronic rumenitis grossly presented devillation, depigmentation, pits, nodules, and infiltration of eosinophils, lymphocytes, mononuclear macrophages, and multinucleated giant cells. Anatomically a large majority of the lesions of rumenitis was located in the anterior ventral sac.

Of all livers examined, 32.38% contained abscesses. The Chi Square Test of Independence showed high statistical significance for the association of gastric lesions and liver abscesses.

Livers and stomachs of 630 unfattened calves approximately four to six months of age were also studied. Livers were examined for abscesses, the rumina for rumenitis, and the abomasa for ulcers and erosions. Of all calves examined, only three contained abscessed livers. The incidence of rumenitis was low and the incidence of abomasal ulcers and erosions was high.

Experimentally, acute rumenitis was produced in cattle by feeding barley to animals which were unaccustomed to grain in their ration. Ruminal motility diminished and acidity of ruminal contents increased to pH 4.0. Grossly and microscopically, experimental lesions were similar to spontaneous acute rumenitis.

Viable Spherophorus necrophorus was injected intraportally into 33 cattle, 20 sheep, and six swine. Subsequent to inoculation, cattle were autopsied at intervals which varied from 1.5 to 183 days. Abscesses were found in the livers of 23 cattle, 18 sheep, and no swine. From the center to the periphery each abscess contained necrotic liver tissue, pus, and capsule of fibrous connective tissue. Necrotic tissue reached maximum size in abscesses 29 days of age, diminished in size in older abscesses, and was not found in abscesses older than 100 days. Pus and fibrous connective tissue began to form in lesions eight days of age.

The ability of polyvalent culture filtrates to produce immunity against experimental liver abscesses was studied. Multiple strains of Spherophorus necrophorus were grown in fluid culture media for variable periods of time. Sterile filtrates from the combined strains were injected intraperitoneally into six normal sheep. A series of seven injections was given over a period of 58 days. Twenty-seven days after the final injection, the six immunized sheep and eight sheep not immunized were injected intraportally with viable Spherophorus necrophorus. Sixteen days subsequent to inoculation all sheep were autopsied. Liver abscesses of each animal were counted. Analysis of variance showed no significant difference in number of abscesses in immunized and nonimmunized sheep.

Conclusions were as follows:

1. Under feed lot conditions, rumenitis probably was caused by irritating products of fermentation in the rumen.

2. Through foci of rumenitis Spherophorus necrophorus penetrated portal blood and was carried to the liver where abscesses developed.

3. Liver abscesses had a duration as long as 150 to 183 days.

4. Culture filtrates of Spherophorus necrophorus given intraperitoneally did not immunize against abscesses.

Microfilm copy of complete manuscript of 181 pages, $2.26. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1426.

HEALTH SCIENCES, PUBLIC HEALTH

THE INTRACELLULAR LOCALIZATION OF HERPES SIMPLEX VIRUS IN CHICK EMBRYO LIVER

(Publication No. 5595)

Alan Gray, Ph.D.
University of Pennsylvania, 1953

Supervisor: Werner Henle

Some of the existing literature concerned with the nature of intracytoplasmic and intranuclear inclusion bodies is reviewed.

Two methods for obtaining cellular components in hypertonic and isotonic sucrose solutions are given.

The growth pattern of herpes simplex virus in chick embryo livers following yolk sac inoculation was determined with the finding that infectious virus can be detected in the livers soon after inoculation but that it quickly disappears and then reappears in increasing amounts from 6-12 hours following the time of inoculation. The time of reappearance was independent of the titer of the original inoculum.

Isolated nuclei of normal chick embryo liver cells did not adsorb herpes simplex virus non-specifically. Nuclei of infected cells were found to contain a high percentage of virus but this percentage decreased as the time following infection increased. The titer of infectious virus associated with isolated nuclei could be increased following treatment of the nuclei with M NaCl. The action of M NaCl is discussed.

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THE USE OF VITAL STATISTICS IN THE ESTIMATION OF POSTCENSAL POPULATION CHARACTERISTICS IN THE UNITED STATES

(Publication No. 5755)

Deward Ernest Waggoner, Ph.D.
University of Michigan, 1953

This study is an exploration of the potential value of vital statistics in estimating postcensal age and sex population characteristics for states in the United States. Statistics of population characteristics for states and smaller areas in the United States generally become obsolete several years after a decennial census. While the effects of natural increase on this changing process are easily evaluable through analysis of reported births and deaths, the contribution of internal migration (probably selective with respect to characteristics) have never been satisfactorily defined.

Without attempting to separate the effects of natural increase and internal migration, the hypothesis is advanced that the reported vital statistics of an area for any postcensal year contain clues concerning the number and characteristics of its population for that year.

The approach is essentially one of estimating postcensal age and sex specific mortality rates. Any vital rate defined as

$$\text{rate} = \frac{\text{frequency of events}}{\text{population}} \text{ (round number)}$$

is subject to solution for unknown population provided that the frequency of events and the rate are known. The percentage error of a population estimate so obtained is approximately equal to the percentage error of rate estimate.

Several assumptions were examined for their capacities in estimating postcensal mortality rates. The assumption that states' specific mortality rates change over time in proportion with change in national rates was accepted as the best of the simple linear assumptions. It was tested in detail, and its errors shown when estimating 1940 specific rates of states from their respective 1930 rates applying the factor of national change from 1930 to 1940. While the errors of estimate were judged unsatisfactory for population estimating purposes, they were not significantly greater than the estimating errors from observed linear regression of 1930 specific rates on 1940 rates by the criterion of least squares. Linear correspondence between 1930 and 1940 rates was high and linearity not disproven.

Multiple regression was then applied, assessing the joint contributions of several selected variables in estimating states' specific mortality rates. While high multiple correlation coefficients and satisfactorily low errors of estimate were achieved for 1940 rates with 1940 predictor variables, the equations were not tested for their predictive error on a subsequent year because of unavailability of 1950 census and vital statistics data. Multiple regression equations calculated from 1930 rates and 1930 indices provided unsatisfactory errors greatly exceeding

theoretical error when values of independent variables of 1940 were substituted therein to estimate 1940 death rates.

The 1930 multiple regression rate estimating coefficients were then transformed into state/national ratio estimating coefficients and the respective 1940 state/national ratios of independent variables substituted to obtain estimated state/national ratios of 1940 rates. Errors of estimate by the latter equations showed considerable improvement, but remained unsatisfactory from the viewpoint of acceptable error.

This study offers no definite proof that vital statistics may be useful in estimating postcensal populations within an acceptable error. Attention is called to some unavoidable weaknesses of basic data of the study which might be corrected by use of a better time series of residence data by states. The writer presents some arguments for further study when the 1950 census and vital statistics data become available.

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HISTORY

HISTORY, GENERAL

"THE TALE OF IGOR" STUDIES ON THE QUESTION OF ITS AUTHENTICITY: TRENDS IN THE HISTORY OF ITS CRITICISM

(Publication No. 5617)

Vladimir Šajković, Ph.D.
University of Pennsylvania, 1953

Supervisor: Dr. V. Krévé

The ever-alive interest towards "The Tale of Igor" which has kept the attention of scholars for over one hundred fifty years is justified by the many puzzles and intriguing problems which are connected with it (historically, linguistically, and ideologically), and by the significance which it represents in connection with knowledge, interpretation, and evaluation of the twelfth century Kievan culture.

At the present time attention is drawn to it, and greatly enhanced by the appearance of a "new school of skepticism" directed against its authenticity.

Obscurity exists as to the exact time and place of its discovery. In 1800 appears its first edition. As to the honesty of its first editors there can be no doubt. Strong Ossianic influences prevailed at the time, and "The Tale of Igor" was interpreted and hailed in Ossianic terms picturing "Boyan" as its Russian bard.

After the loss of the only manuscript in the Moscow fire of 1812 a few scholars, holding a general skeptical view towards ancient Russia, claimed it even a forgery of the 18th century, and rose to doubt its authenticity. Their arguments were weak and unscientific. They were defeated by the apologists. Skeptics found no proof for their prejudiced views and arguments. The view of authenticity prevailed, backed by literary discoveries, philological, and historical research. In the latter half of the 19th century doubt and skepticism were overcome.

Apologists of the first half of the 19th century concentrated mainly on explaining obscure passages and corrections of the text. In the second half of the 19th century there is emphasis on the content under literary schools and methods borrowed from the West. Dominating are the mythological school and the school of comparative borrowings. The results were misleading, over-emphasis either on mythological elements or on dependence from Byzantine or Bulgarian influences. They approached the tale basically from a poetic point of view, continuing to regard "The Tale of Igor" as an "heroic song". Ideological content remains in the background. This "poetic" concept and interpretation remains dominant and carries through to the present time, often overlooking the historical reliability and exactness of "The Tale of Igor". In Soviet Russia the emphasis has shifted now to the ideological-historical approach, but is spoiled by political doctrine. In textological criticism controversies appear not only in connection with corrections and conjectures of separate "unclear passages" etc., but also as to the need of making greater changes in the text as, for example, replacments of some entire passages and paragraphs, voiced by few scholars. No unifying view, method of study has been established.

In the meantime voluminous historical, philological, and literary material has been uncovered and brought in connection with "The Tale of Igor", proving its reliability and authenticity.

Mazon's new skepticism in method and conclusion has provoked international debates and refutations from outstanding scholars in and outside Russia. He assimilates and repeats 19th century skepticism and methodological errors appearing in previous studies. His new hypothesis: "Zádonština" the primary source of "The Tale of Igor", is intended as a more radical attack on its authenticity.

The new skepticism must be taken into consideration; it cannot be ignored. Each scholar must clarify his own basic attitude, view and approach.

Question of a new, basic, unifying view and method of study arises. Suggested principles for further study as represented by individual scholars could be put together as follows: finally abandoning the

approach to "The Tale of Igor" as a "fantastic" poem; uncovering and establishment of original purpose of the tale — its "raison d'ètre"; firm reliance on its historical reliability proven by linguistics, archeology, etnography, etc.; in approach to the text: abandoning the "myth" of its undistorted condition since the 12th century; acceptance of alterations in the text. These would establish a new methodological approach in the study of "The Tale of Igor".

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HISTORY, MEDIEVAL

SOME MEDIEVAL RELIGIOUS AND PHILOSOPHICAL SURVIVALS IN SEVENTEENTH CENTURY FRANCE

(Publication No. 5527)

Roger Dan Derby, Ph.D.
University of Minnesota, 1953

The present thesis is an essay in cultural or intellectual history. Based upon the belief that the character of an age must be defined in terms of its fundamental convictions, it notes that for many centuries man's mind was dominated by a special conception of God, namely, Trinitarianism. That is, the Idea of God furnished the major principles of philosophic endeavor. When thinkers sought to explain the reasons, essences, and purposes of things, they felt compelled to refer back to the properties and intentions of the Deity.

In the thirteenth century St. Thomas Aquinas had asked numerous questions about the world and man and their relationship to God. Other philosophers before and after St. Thomas speculated not only about these problems but also about the use and significance of the various arts. The answers which all of them gave reflect a consistent attempt to interpret the universe theologically.

The Idea of God, a compound of revelation and reason, of Greek, Hebrew, and Christian notions, embraced the assumptions that He is existent, living, pure act and form, one, three, transcendent, immanent, free, simple, infinite, immutable. With such qualities it mingled the further suppositions that God is Truth, that He exceeds other beings in goodness and guides them toward the Good, that He is self-revealing, and that He acts in conformity with His essence. Altogether, those principles which described God's nature and those which heralded His activity implied the presence of a universe which images its Creator in manifold modes of being, requires His providential attention, and moves as He directs.

The impetus of medieval Trinitarian theology carried through to the seventeenth century in France, a period which is often called revolutionary. Descartes, Pascal, Bossuet, and Malebranche all confessed the God of Augustine and Aquinas, acknowledged the ultimate rights of revelation over reason, and even bent philosophy to the service of Christian apologetics. Innovators in the sense that they transferred their allegiance from an animistic to a mechanistic conception of the universe, these men nevertheless remained children of the past, to a considerable extent, in their Idea of Nature, Knowledge, Human Affairs, and Art. They looked upon the world as an entity that derives its being, law, and continued existence from the Almighty. They recognized divine purpose in the symbolism of creatures and in miraculous occurrences. With the possible exception of Descartes, they admitted the disruptive consequences of original sin for nature and natural order.

Their account of the knowledge problem also took sin into consideration, especially its disturbance of the relation between sense perception and reason. Furthermore, their epistemological theories conceded God's role in human mental processes.

Finally, when these philosophers and certain of their fellow intellectuals reflected upon the deeds and institutions of man himself, they invoked the Deity once more in search of meanings. God, they taught, forms, sustains, and counsels individual earthlings. He presides over the welfare of states, decrees the direction of history, and obliges all His creatures to cooperate in the realization of His eternal plan.

In music and literature, painting and sculpture, they announced His primacy by their selections of subject matter; and unwittingly they may have betrayed an essentially Christian bias toward life in their shaping of themes which properly belonged to a different civilization. Their opinions concerning the character, use, and freedom of the arts together with persuasions as to the symbolic value of words, tones, and things in nature provide additional evidence of theology's authority. Thus the prestige of Trinitarianism still dazzled the seventeenth century mind, and the Idea of God set its stamp upon scientific, political, social, and artistic pursuits.

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THE ROYAL TALLAGE OF THREE ESCHEATED HONORS, WITH INTRODUCTORY NOTES CONCERNING THE FARM OF THOSE HONORS

(Publication No. 5486)

Robert Shibley Moth, Ph.D.
State University of Iowa, 1953

The original purpose of the dissertation, The Royal Tallage of Three Escheated Honors, was to examine the tallage liability of manors of honors that had escheated to the king of England during the latter half of the twelfth century, both during the

period of escheat and after the manors, or their honor, had been regranted, and also to determine the tallage liability of the royal demesne and non-demesne manors associated with these honors. The three honors examined are the honor of Earl Giffard, of Wycombe-Wallingford and of Boulogne.

The period of each honor's escheat was determined by noting the interval between the first and last years that the farm of the honor appeared in the pipe rolls. The period that each manor was in the king's hand was determined by noting the interval between the first appearance of the manor's farm and the first appearance, if any, of an allowance from the farm of the honor in the manor which was equal to the farm of the manor. If the farm of the manor was greater than the allowance, it was assumed that the manor had been partially regranted. If the farm and the allowance were equal, the manor had been wholly regranted. The regranted manors were occasionally, but not always, described as terrae datae. Thus, the nature of the problem requires that the dissertation be concerned as much with the honorial farm as with the tallage of the honors.

The "farm of the honor" was found to have a restricted meaning. It was the total of the farms of those manors of an escheated honor which were or had been in the king's hand and no other manors. It did not appear to include the farm of royal demesne manors; these were found to be accounted in the shire section of the rolls. It was evolved over a period of about nine years. An exception in this regard is the farm of Earl Giffard's honor which was fixed in amount from the time of its first appearance until the end of the reign. Once established, the honorial farm remained fixed. Only after the farm had become fixed did the allowances from the farm for terrae datae appear.

Manors of the escheated honors paid tallage in 1168, 1172, 1173, 1176 and in 1186, provided they had not been regranted. In contrast, royal demesne manors paid tallage both during and after the honor had been regranted. But it is believed that they were not actually a part of the honor, that they were attached to the honor in the rolls because of the terrae datae allowances in them which were deducted from the honorial farm and not for any other reason.

The royal demesne and non-demesne manor relationships with respect to tallage are described by the pipe roll expression, "...royal demesnes and lands which were then in the king's hand." At first, this dual description or concept correctly described the two kinds of tallage paying manors. But later, as the non-demesne manors, that is, the manors of the honorial farm, were regranted and ceased to pay tallage, the manors described beneath the dual concept were virtually all royal demesnes. The effect was a narrowing of the tallage incidence; and in fact, far fewer manors associated with the three honors paid the tallage of 1186 than paid the aid of 1168.

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THE SOCIAL AND ECONOMIC POSITION OF THE FLORINTINE ARTIST IN THE FIFTEENTH CENTURY

(Publication No. 5750)

Wallace John Tomasini, Ph.D.
University of Michigan, 1953

To see the complete picture of forces acting upon artists of Florence is to realize the complexities of the controlling factors of this society. These conditions of fifteenth century Italy nurtured man's basic need for fame and prestige, and intermeshing circumstances made this quest more obtainable.

The primary prestige of learning and scholarship was not new in the Renaissance, as it grew gradually from the fourteenth century. As Aeneas Sylvius and Mapheus Vegius demonstrate, prestige is identified with secular learning which is fashionably connected with classicism. Classical knowledge then determines the cultivated individual.

Alberti, da Vinci, Ghiberti, and Cennini recognized this prestige index. They made the initial attempt to identify the artist with the scholar. This alone would remove the artist from the low craftsman category. Before this could be realized it would be necessary to associate figurative arts with liberal rather than mechanical arts. With this achievement the prestige of artists would be correspondingly enhanced.

Following this necessity for associating letters with the arts is the reevaluation of aesthetic thought. As society in the later middle ages became more involved with the physical world and less with the spiritual, aesthetic thought adjusted towards a more naturalistic basis. They reasserted the mimetic concept of antiquity. With the fifteenth century, the plastic expression of this aesthetic has found its energies in empirical studies which replace the traditional stylized medieval forms. These studies of perspective, foreshortening, and anatomy involve the artist in spatial and mathematical theory. This brings him to a closer affinity with humanists, the chief allies of artists and the most instrumental in their final victory.

The humanists so emulated classical authors that they too had to become involved in artistic affairs. Then they took up the cause of the figurative arts and demanded for them a position amongst the liberal arts. This was done for their desire to be identified with classical authors and for their personal aggrandizement. The humanist succeeds because the artist, like him, is instrumental in gaining immortality and fame. In an age dedicated to fame and virtue an artist is in demand. Together the prestige of the humanist, the patron, and the artist are enhanced.

Next is the identification of artist with humanist, followed by the realization that the artist is, in a sense, a humanist himself. Through mathematical and theoretical studies and also through literary endeavors artists enter the outer circles of humanists. Through developing similar interest and association with the literati the artist becomes a man of letters, of cultivated tastes, a gentleman.

These circumstances had deleterious effects upon the guild organization. The more modern and empirical artist's intellectual character alienates him from the artisan references of the guild, which is less able to fulfill its function. Besides, its standards for training are outmoded by the empiricists requiring a more technical and theoretical education.

That these factors enhanced the status of the artist is seen both socially and economically. We shall see how they are praised by humanists, princes, wealthy patrons, and communes. They are honored and respected during their lives for their technical abilities. Some are raised to the knighthood. Their success as artists merits their social prestige as does their monetary resources. Most live comfortably, and several die relatively wealthy men. We see then how the new intellectualization of artists and the arts enhances the artist's status, and he emerges not as another craftsman but as a creative genius, an individual who expresses the ideals and values of society.

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HISTORY, MODERN

THE OPERATION OF THE ENGLISH NAVIGATION SYSTEM IN COLONIAL PENNSYLVANIA, 1681-1750: A CASE STUDY

(Publication No. 5888)

Leonard Allen Adolf, Ph.D.
University of Washington, 1953

This is a study of the enforcement of the navigation and trade laws in colonial Pennsylvania. The laws considered are those which were passed by Parliament between 1651 and 1750. The study briefly states the mercantilist attitude toward colonial possessions and traces the empirical development of the English laws and Crown and Pennsylvania institutions which were in theory designed to guarantee England a maximum of benefit from colonial trade.

The types of illegal trade engaged in by Pennsylvanians during this period are surveyed and the many problems and conflicts which arose over the enforcement of the English navigation system are presented. In addition an attempt is made to illustrate the manner in which some of the major conflicts were resolved. The actual economic contributions which Pennsylvania made to England and the empire are depicted.

The story of the methods of the enforcement of the navigation and trade laws is given. An effort has been made to show how the vagueness of the laws, a lack of a constabulary and patrol vessels, and difficulties over the respective jurisdictions of Crown and colonial officials, made many aspects of the enforcement of the laws almost impossible to enforce.

The dissertation indicates that despite the general failure of the trade laws in Pennsylvania, the navigation acts aided in providing shipping from Pennsylvania for the British merchant marine. The navigation laws were also instrumental in assuring a favorable balance of trade to England in the direct trade with Pennsylvania.

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EUROPEAN IMMIGRATION INTO CANADA, 1946-1951

(Publication No. 5778)

Nathaniel Constantine Allyn, Ph.D.
Stanford University, 1953

Between 1946 and 1951 over six hundred thousand immigrants entered Canada. The influx of these large numbers, however, was neither representative of the immigration figures of the preceding thirty years nor of the policy upon which the admission of newcomers had been based. On only two other occasions had there been a comparable population increase due to immigration — the American revolutionary period and the seventeen years after 1896. The optimism of the last decade of the nineteenth and early years of the twentieth centuries, however, was replaced by pessimism during the interwar period as the nation was beset with problems which directly affected its immigration policy. The virtual closing of its doors between 1919 and 1937 was the result of such factors as the economic depression during the 1920's and 1930's, opposition to immigration from the public in general and organized labor and French Canada, in particular, and the restrictive immigration laws adopted by the United States in the 1920's.

The Second World War, nevertheless, gave new impetus to the "push" and "pull" forces which cause human migration. It not only increased the demand for additional laborers in the Dominion but caused hundreds of thousands of Europeans to look hopefully across the Atlantic for new homes. Informed Canadians realized that if the high level of prosperity established between 1939 and 1945 was to be maintained, the nation's immigration policy would have to be liberalized with the aim of admitting the required number of workers for specific industries. Despite the vehement objections to such a proposal by a few French Canadians in Parliament, the Liberal Government correctly interpreted the attitude of the people as supporting such a move. Consequently, between 1947 and 1951, nearly two hundred orders-in-council were appended to the Immigration Act and Regulations which broadened the categories of persons admissible. As in the past, emphasis was laid on encouraging individuals who were willing and able to

fill the labor gaps in unskilled and semi-skilled occupations, especially farming, logging, mining, domestic service, and construction.

Although more newcomers entered from the British Isles than from Displaced Persons' camps, the most notable feature of Canadian immigration during the six years was the migration of over one hundred and fifty thousand Displaced Persons, mainly from eastern and northeastern Europe. Not only did they aid in meeting the labor shortage which threatened many industries, but the Displaced Persons added new lustre to the Canadian mosaic by the introduction of new industries, skills, and culture. Conversely, Canadians assumed the responsibility of helping them adjust to and feel at home in their adopted land. The tightening of immigration regulations beginning in June, 1952, was sternly opposed by those who felt that the Dominion could easily accomodate many millions more than it already had. While this may be possible in the distant future, there is no valid reason for believing it will take place until Canada is able to conquer time and space in order to take advantage of its wealth of natural resources.

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THE FUR TRADERS IN NORTHERN INDIANA, 1796-1850

(Publication No. 5853)

Bert Anson, Ph.D.
Indiana University, 1953

The lake region of Indiana north of the Wabash River remained in Indian possession several years after surrounding areas were occupied by white settlers. The Indian trade was its most important feature. The white traders of the Indian period made the transition to white merchandising, political organization, agricultural development, and the complexities of American urban life.

Northern Indiana was a part of the larger area which came under American political control after the treaty of Greenville in 1795. The fur trade remained a Canadian monopoly until 1808, when John Jacob Astor first entered the Great Lakes trade. From 1795 to 1815, the fur trade suffered from the Napoleonic wars, and from the border war of 1811-1815. Through this period, Mackinac Island and Detroit were the bases from which Indian furs were sent to Montreal. Some traders exerted great influence on the Indians during this period, especially Robert Dickson, John Kinzie, and J. B. Chandonnai, but most traders were neutral or pro-British. Astor controlled Indian trade south of the Great Lakes from 1815 to 1834. Small independent traders entered the area and operated through his American Fur Company.

His principal base was at Mackinac Island, and the raccoon and muskrat of the Northern Indiana region was the most profitable item of the trade. Ft. Wayne became the center of the Wabash trade routes to Detroit. Astor secured the abolition of the Federal Trade House System in 1822, leaving the Indian agency station at Ft. Wayne to become the center of Indian trade. John Tipton assumed a leading place in the trade from 1823 to 1839 as agent, at Ft. Wayne until 1827 and then at Logansport.

The Indian treaties of 1818, 1821, 1826, and 1832 purchased title to Northern Indiana. The traders monopolized the treaties. They sold merchandise, presented claims, purchased reserved lands, and controlled the Indian chiefs. Settlement developed along the routes of transportation. These were the Wabash-Maumee route, the St. Joseph River, and in the 1830's along the Michigan Road. The traders were assisted by the completion of the Erie Canal which made New York the principal financial center of Northern Indiana, and enabled such firms as Suydam and Sage to become the most important agents of the fur trade.

The period until 1832 was devoted to the fur trade because it enabled the traders to secure financial resources and advantageous speculations. These assets made the traders the most important and substantial element when white settlement took place. They secured most of the important town sites, water power, ferry and bridge charters, political offices and were leaders in banking and internal improvement movements.

The speculative period of the 1830's caused a decline in the fur trade, as the emigration policy for the Indians gained strength. The panic of 1837 revived the Indian trade, which culminated in the fur wars of 1838-1842 between the reorganized American Fur Company and the Ewing companies. This war, and the advantages of an Indian population as a source of income, was a great aid to Indiana merchants' recovery from the panic.

The Indians were removed from Northern Indiana between 1830 and 1850. By the later date, their economic importance to the whites was superseded by the increasing white population. There was a fur trade, but it lost its supremacy to the wheat, corn, pork, and other products of the new settlers. The Indian traders made the transition to the new opportunities. They entered every new speculative field. The general store was the most popular line of business,a logical development of the Indian trade. Many traders entered business partnerships as they could operate over a wider area, or because they possessed limited resources. This dispersion of energies seems to account for the limited success of many traders.

The Indians were practically defenseless before the white migration. Their chief advisors were the traders, most of whom were solicitous for their customers, and from whom they received considerations at least equal to that given white pioneers. The most unscrupulous men in the Indian trade were the Indian chiefs.

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THE POLITICAL BANQUET CAMPAIGN IN FRANCE, 1847-1848

(Publication No. 5637)

John Joseph Baughman, Ph.D.
University of Michigan, 1953

This study is the history of the movement for political reform in France as expressed in a series of political banquets held by the leaders of the opposition from July, 1847, to February, 1848. For the first time the banquets have been located, catalogued, and analyzed. The study looks upon the campaign as an entity in itself, showing how the banquets were connected with one another by ideas, leadership, and organization. It relates the banquet campaign to the development of liberal and democratic political institutions in nineteenth century France, to the liberal thought of the French bourgeoisie during the closing years of the reign of Louis Philippe and the period of the Second Republic, and to the immediate background and causes of the February Revolution of 1848.

The study examines first the political situation in France at the end of the July Monarchy, observing the reasons for the reform banquets. Next the banquets themselves are discussed with particular emphasis on their organization and political position. The story of the fifty-nine banquets is told with two banquets being especially noted, that of Paris which served as a model and that of Lille which initiated the split of the campaign into two factions, moderate and radical. The position of the campaign in the outbreak of the February Revolution and the reaction of both local and national government to the banquets are examined. Certain parallel reform movements, such as the use of petitions, the work of conseils-generaux, and the attitude of the French press are investigated. The men and ideas of the campaign are analyzed, and finally the reaction of the banquets upon France is studied.

The banquet campaign failed to accomplish its goals, to arouse the French people to act for political reform, to encourage the Government to initiate reform legislation, and to unify all the factions of the opposition. The indirect results were important in the history of France: (1) the campaign was significant in the struggle for free political assembly in France; (2) the attention of France was focused upon its political difficulties in 1848; (3) a new vigor was brought into French political life; (4) electoral and parliamentary reform was made the order of the day; (5) for the first time there was an organized political opposition to the domestic policy of Louis Philippe.

The study reaches three general conclusions. The banquet campaign was significant in the development of the right of free assembly, the right of free political expression, and the increase of manhood suffrage in France. The banquets were an expression of the political philosophy of the French liberals of the early nineteenth century, especially the men who determined the course of the Second French Republic. Finally they formulated the political causes of the French Revolution of 1848.

Microfilm copy of complete manuscript of 328 pages, $4.10. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1436.

NAPOLEON AND THE GOVERNANCE OF NON-FRENCH SUBJECT PEOPLES

(Publication No. 5891)

John Louis Beatty, Ph.D.
University of Washington, 1953

This work as the title implies, deals with the ideas of Napoleon on the methods of ruling those national groups which fell into the French hegemony of the early nineteenth century. The word "governance" also contains implications of a system, of a deliberate plan for that rule, and that concept presents the major argument of the work — that Napoleon did actually have a system of government and a fairly rigorous plan and routine for establishing a new government in the countries he brought under his control. But it must be emphasized that, although he tried to pattern his system and the new regimes under the examples found in France, certain limitations must be placed upon the use of the term "Napoleonic system", particularly in the realm of financial and economic affairs. It must also be emphasized that this thesis deals only with Napoleon's ideas on the art of government, with what he conceived to be best or worst for his subjects and for the perpetuation of his rule, and not with the actual history of the reforms themselves within the several countries.

In outline, Napoleon sought to bring many of the progressive features of the French Revolution to the peoples of Europe, such as, the abolition of the feudal-manorial survivals, religious liberty, equality before the law, and abolition of the fiscal immunity enjoyed by the privileged classes of the older societies. The major instrument for these reforms was the installation of the French civil law code as the new law of the land. Other, more positive, reforms made up a part of the Napoleonic system as well — a new Imperial nobility which was to bind the states of the Imperium more closely to the French Empire and also to serve to amalgamate the new and the old aristocracies, a stream-lined administrative organization making government simpler, more orderly and more efficient, a uniform system of coinage and of weights and measures to simplify commercial

relations, among others. Beneath all these changes rested two concepts held by the Emperor. Government should be logical and it should be simple, and these two accounted, to a great extent, for the reforms which comprised the Napoleonic system.

It was felt throughout the thesis that a legitimate distinction could be drawn between France proper (or the Empire) and the system of states surrounding that country and generally ruled by one or another of Napoleon's family (called the Imperium). This difference seemed usually clear in the mind of the Emperor and indicated a great deal of his plans for the re-organization of Europe under his leadership, especially in regard to his aims at stabilizing his rule there. Thus, his choice to rule the Kingdoms of Italy, Naples, Holland, Spain and Westphalia indirectly, through the members of his family, both complicated the administration of the French hegemony, and in addition demonstrates the restricted nature of his ambition and the final character of his system. For these reasons the distinction between Empire and Imperium is significant.

There is only one reliable source for the ideas of Napoleon. The many letters and orders issued by the Emperor through his career are the one truly indispensable body of material, especially after all necessary collations are made between the various editions of letters. These may be supplemented by his later writings (as at Saint Helena) or by the memoirs of his associates, but only where these are supported by his actions or by his statements from the time when the affairs were themselves active and important can they be held as trustworthy. Here the major reliance has been placed on the 32 volume official edition of the Correspondance, and the additions to the published letters, orders and decrees made by Lecestre, du Casse, Brotonne, Cerf and Grouchy.

Microfilm copy of complete manuscript of 347 pages, $4.34. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1437.

WILLIAM EDEN AND THE AMERICAN REVOLUTION

(Publication No. 5643)

Alan Scouler Brown, Ph.D.
University of Michigan, 1953

The object of this study is to trace the public career of William Eden in the era of the American Revolution. In this period Eden was one of the group of young politicians who held minor offices in the British government of George III and Lord North. The focus of the work has been Eden's ideas on, and his part in, the policies of the government toward America. Although he was not directly responsible for policy making, he did influence its formation. The details of his relations with the ministers and other officials bring out the aims of the British in the war and also shed light on the political difficulties of the North administration.

In the early years of his public life Eden enjoyed a rapid rise in official circles as a result of his ability and important connections. He was appointed an Under-secretary of State and later was given the direction of the foreign secret service. In 1778 Eden was chosen one of the three civilian members of the Carlisle peace mission, and went to America with this, the last serious conciliatory offer before the final peace. His activities in connection with the concialitory mission constitute the most important phase of his career during the war. The British government, however, failed to realize that peace offers withholding independence were futile after the signing of the French alliance. Eden thus found himself in America on a fruitless errand, and the failure of his mission embittered him against the government.

Upon his return to England he engaged in various political intrigues which had a disturbing effect on the North administration. His activities from 1779 to the end of the war reveal him as a politician not above distressing the government for private ends. The details of his career in this period thus help to bring out the difficulties that George III and Lord North had in keeping a stable administration.

This study of William Eden in the War of American Independence reveals him as a representative politician of the era of George III — one of a group of men who were motivated more by self interest than by considerations of national welfare. The misconceptions of the British government regarding the situation in America are clearly shown, and Eden's part in fostering them made apparent. The study also shows the problems of the North ministry in conducting a war with the American colonies and the Bourbon powers; and at times it is evident that the political intrigues of Eden and others often presented more of a problem for the ministry than the exigencies of the war itself.

Microfilm copy of complete manuscript of 214 pages, $2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1438.

FATHER ROBERT PERSONS, S. J. EARLY YEARS: 1546-1582

(Publication No. 5582)

John Paul De Cecco, Jr., Ph.D.
University of Pennsylvania, 1953

Supervisor: Conyers Read

Fr. Persons lived an active life of sixty-four years, one beginning in 1546 and ending in 1610. That fragment of his life considered here can be described as the purely sacerdotal phase of his missionary activities. The climax of this period occurs in his missionary labors among English Catholics. His later career as diplomat, founder of seminaries for English missioners, and controversialist could never reach the height of heroism nor show the depth of conviction of the man who, in 1580, travelled several

hundred miles on foot to bring to Catholics in England their greatest hope for victory in two generations.

Born of humble parentage in Somersetshire, educated at Stogursey and Taunton, and Balliol College, Oxford, Persons was one of the young men of his day who felt that a synthesis based on new values could not replace adequately the old ideal of life as embraced in the discipline of the Catholic Church. In 1575 he left England, and in a few months entered the novitiate of Sant' Andrea in Rome. By 1578 he received Holy Orders and an appointment as English Penitentiary at St. Peter's. He acted as mediator in the dispute which arose in the English College, Rome, at the time of its foundation in 1578, and in 1580 he was named superior of the English mission, which he and Campion were to found for the Society of Jesus.

Leaving Rouen in April, a company of twelve priests journeyed to Rheims, and then to vatious ports of embarkation for England. In June both Campion and Persons were in England, and in July, at the Synod of Southwark, the Jesuits explained the nature of their mission and established a uniform discipline for English Catholics. Campion and Persons began their missionary tour from Uxbridge, where, in declarations entrusted to Thomas Pound, they re-affirmed the purely religious interests of their present work. In this Persons had the material aid and companionship of a rich English gentleman, George Gilbert.

With the help of Stephen Brinkley, Persons established a secret Catholic press which printed three of his works: A Brief Discours, explaining why Catholics could not attend the Anglican service, a Brief Censure, replying to two attacks made on Campion's Challenge, and A Discoverie of I. Nicols, answering a venemous attack on the Church by an apostate. These publications in addition to the government proclamations which heralded their entrance into England and the penal legislation of 1581 increased the severity of the persecution, gravely threatened their work, and finally resulted in the capture of Campion. Persons was forced to flee London, and after a serious debate with himself he decided to leave for the continent in order to conduct important business which could not be entrusted to letters. He left England in the middle of August, never to return, and spent most of the fall and winter in Rouen. While secretly residing there he wrote his De Persecutione Anglicana, his Defence of the Censure, and his penetrating Book of Resolution. This last work is a devotional treatise of spiritual depth and intensity: in language of modern significance, if sombre in tone, courageous in intention, Persons tells us of the tragic finitude of all life, the vanities of a distracted world, and the irresolute wills of men who have become a periphery of sundry and disorganized interests.

Microfilm copy of complete manuscript of 306 pages, $3.83. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1439.

THE NEW YORK DEMOCRACY: DIVISION AND REUNION, 1847-1852

(Publication No. 5586)

Walter L. Ferree, Ph.D.
University of Pennsylvania, 1953

Supervisor: Roy F. Nichols

In the fall of 1847 the New York Democracy split irrevocably into the Hunker and Barnburner factions. The recognized leader of the latter was John Van Buren and the activities of the Hunkers were directed by a corps of men headed by Edwin Croswell and Samuel Beardsley. The ostensible reason for the rift was the Wilmot Proviso but behind it were a myriad of personal, economic, and political factors. Through a series of conventions each segment perfected its organization in preparation for the presidential contest of 1848. In that struggle Martin Van Buren abandoned his retirement to become the directing genius of the Barnburners and the standard bearer of the Free Soil party. His motives were varied, but occupying the primary position was his desire to reestablish the North-South balance within the party by convincing Southern Democrats that cooperation with the North was essential to the safety of the party and of the Union. By making possible the Whig victory in the state and nation, he brought on the downfall of those who had ruined his chances in 1844 and, in New York at least, set the stage for the resurgence of the Van Buren machine.

Since the strategy of the Barnburners called for the defeat of the Whigs under their management, a reuniting of the factions was a necessity. In 1849, union was achieved on a modified Proviso platform and the state ticket was equitably divided. The Barnburner most active in this movement was John Van Buren, and his Hunker counterpart was Horatio Seymour. Two casualties resulted from the reuniting of the sections, namely, the New York Free Soil organization and Hunker unity. In the latter group, those who opposed joining with their erstwhile partisan foes became known as the Hards and were led by Daniel S. Dickinson, Samuel Beardsley, and Edwin Croswell; those who willingly combined were called Softs and were managed by William L. Marcy, Horatio Seymour, and Darius A. Ogden.

During 1850 and 1851 the New York Democracy continued to be disturbed by national and local problems. The slavery controversy, in the guise of the Compromise measures, continued to be troublesome; such local and personal issues as the senatorial question, the problem of canal construction, and the battle for control of the state organization, widened the breach between the Hards and the Softs. The division had become so pronounced by the eve of the election of 1852 that it was patently impossible for them to unite upon a candidate for the presidency. The Hards backed the pretensions of Lewis Cass and the Softs gave their support to William L. Marcy. The Van Buren element of the latter faction could not acquiesce in the nomination of Cass because of 1844 and 1848, and the personal antipathy which

Dickinson and the other Hards had for Marcy created doubt as to his ability to carry New York in the election. As a result, the Baltimore Convention nominated Franklin Pierce. The same body tacitly recognized the Van Buren machine as being Democratically orthodox by selecting John P. Beekman, the personal friend and neighbor of Martin Van Buren, to replace Edwin Croswell on the Democratic National Committee.

Each group accepted the nomination of Pierce for reasons peculiar to itself: the Hards were gratified with the platform and its endorsement of the Compromise; the Softs had thwarted the ambitions of Dickinson and Croswell; the former Barnburners had defeated Cass, regained their position of prestige in local affairs and, with the admission of California as a state, had rendered impotent the power of the advocates of slavery extension. Therefore, all Democrats joined in advancing the fortunes of the Baltimore nominee, and in advocating acceptance of the platform with its endorsement of the Compromise measures.

Microfilm copy of complete manuscript of 512 pages, $6.40. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1440.

THE LIFE AND TIMES OF GOLDEN RULE JONES

(Publication No. 5669)

Harvey Seabury Ford, Ph.D.
University of Michigan, 1953

Samuel M. Jones, one of the most famous of American reform mayors, was born in Wales in 1846 and at the age of three was brought to America by his parents. After an impoverished youth in Western New York state, Jones went to the Pennsylvania oil fields in 1865 and found his life's work. Jones prospered in Pennsylvania, and in 1886 he followed the oil boom to Lima and the newly opened field in northwestern Ohio. While living in Lima, Jones invented a device for use in oil-well pumping which was to be the basis of his fortune. Late in 1892 he moved to Toledo and began to manufacture his device.

The great depression of 1893 coincided with the beginning of Jones' manufacturing venture, and he wrote afterwards that the sight of crowds of unemployed men coming to his factory to beg for work caused him to revise all his notions about the functions of society. Jones established the Golden Rule as the only condition of employment in his factory and in the course of time effected many reforms for the benefit of his workmen. He put into effect the eight-hour day and a daily minimum wage of $2. He gave his employees a week's vacation with pay and 5 per cent of their wages as a bonus at Christmas time. These innovations were sufficiently unusual in the 1890's to arouse comment, and Jones acquired considerable renown and prestige in Toledo.

Jones embarked upon his political career in the spring of 1897 as the result of a deadlock in the Republican city convention over the nomination of a candidate for mayor of Toledo. Jones, a genuine dark horse candidate, was nominated and elected by a narrow margin. Jones then allied himself with the Foraker faction among the Republicans, which was dominant in Toledo, and took a hand in the unsuccessful attempt to defeat Marcus Alonzo Hanna for election to the Senate. By the spring of 1899 the Hanna men had gained control of the Republican organization in Toledo, and Jones was consequently defeated for renomination for mayor. He thereupon ran as a nonpartisan and polled twice as many votes as the combined vote of the Republican and Democratic candidates.

As mayor of Toledo, Jones consistently advocated the principle of municipal ownership and unsuccessfully attempted to secure for the city a number of public utilities. Jones' chief accomplishment as mayor was the reform of the municipal police force, which he put upon a civil service basis. He substituted light canes for the heavy clubs carried by the police and did much to humanize police procedure. Jones also bitterly attacked police court methods, which he claimed were too harsh on the poor.

In 1899 Jones ran for governor of Ohio as a nonpartisan, and was defeated. In 1900 he supported Bryan, and in 1901 he was re-elected mayor as a non-partisan with a Democratic endorsement. After 1901 Jones became an ally of Tom L. Johnson, the leader of the progressive Democrats in Ohio. In 1903 Jones was elected to a fourth term as mayor, but by a plurality only.

Jones was on good terms with all the leading politicians of reform, from Bryan to Debs, and was in demand as a lecturer throughout the country. Long before his death in 1904, the mayor of Toledo had achieved lasting national fame as Golden Rule Jones.

Microfilm copy of complete manuscript of 759 pages, $9.49. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1441.

THE STRUGGLE FOR THE BRITISH NORTHWEST: A STUDY IN CANADIAN-AMERICAN RELATIONS

(Publication No. 5532)

Alvin Charles Gluek, Jr., Ph.D.
University of Minnesota, 1953

Nature had decreed an inter-association of the British and American Northwests. The Northern Great Plains are a geographic entity; and while there are three means of access to this interior plain, the southern route, the Red River Valley, is the best. Once accessible to the Red River Colony of the British Northwest, the advancing American civilization created an economic relationship of far-reaching effects. An economic complex grew without regard

for the 49th parallel and fashioned a vast, "free-trading" area.

As economic intercourse became more fluid, so did all the human relationships. Religious bodies in both Northwests enjoyed a closely knit kinship. Protestants and Roman Catholics expanded their organization and teachings in accord with the regional unity. Education had its international aspects and so did marriage. Parents crossed and re-crossed the 49th parallel. A cultural relationship developed, abetted by the growth of communications; and by 1860, the citizens of the Red River settlement were more closely associated with Minnesota than with Great Britain or Canada.

The expansion of Minnesota's frontier did not keep pace with the growing socio-economic relationship. The land "boom" of the 'fifties ended in the Panic of 1857. But challenge evoked a response. In 1858-59, Minnesota experienced her "great awakening," stimulated by a gold rush in the Pacific Northwest, the British Report of the Select Committee on the Hudson's Bay Company, 1857, and the decision of the Company to utilize the American highway for part of its traffic. Moreover, in the late 'fifties, the interest of men everywhere in Great Britain, Canada, and the United States was turned toward the Northwest.

Transportation in the Northwest underwent rapid developments, with an interlocking stage and steam line that ran from St. Paul to Fort Garry. Pioneer settlements mushroomed along the stage route and inched down the Red River Valley. But Minnesota's progress was interrupted by the Civil War and the Sioux uprising. The frontier remained virtually unchanged from 1861 to 1865.

Relations between the two Northwests were relatively untroubled by the Civil War. Minnesota's Anglophobia included neither Canada nor the Red River Settlement. But after Appomattox, her mood changed to outright expansionism. For, with the end of reciprocity and the rise of Canadian Imperialism, it appeared that St. Paul's commercial destiny was doomed.

Canada's "great awakening" was concurrent with that of Minnesota, but early attempts to create a commercial alliance with the British Northwest were foredoomed by nature and the absence of federation. The Dominion emerged from the crucible of the American Civil War. Canada needed the Northwest. Without it, her political future was uncertain, for the vacant arable land was fast disappearing. Without the Northwest, Canada would be prevented from union with British Columbia. The key to Canada's destiny was the Red River Valley; and in the Riel Rebellion, the door was nearly locked.

Americans failed to use the rebellion as a lever to extract the British Northwest. Annexationists within the Red River Settlement overplayed their hand and gained only hostility for themselves and the United States. President Grant's policy was similarily unsuccessful. He sought the independence of Canada, he tried to buy the Northwest, and he attempted to obstruct Canada's efforts to get her West. He only deepened Canada's hostility without aiding Riel or the United States.

Grant was out-generalled by Sir John A. Macdonald. The Canadian premier knew that the United States would not go to war; but as added insurance, he included British troops in Wolseley's expedition to the Northwest. He yielded to the majority of the métis demands and softened their anti-Canadian temper. And he temporarily quieted the amnesty troubles with his douceur to Riel in exile. By August 1870, Canada had her West.

Microfilm copy of complete manuscript of 504 pages, $6.30. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1442.

CIRCUIT CHAUTAUQUA, A MIDDLE WESTERN INSTITUTION

(Publication No. 5470)

Donald Linton Graham, Ph.D.
State University of Iowa, 1953

The circuit Chautauquas, which presented their programs under tents during the summer months from 1904 to 1933, have been the subject of widely differing opinions. This study, which is based primarily upon the records of the Redpath Chautauquas of Chicago, but employed records of the Redpath-Vawter Chautauquas as well as interviews with several former bureau managers and other sources, is an attempt to reexamine and evaluate the movement.

Circuit Chatauqua, from its founding in Iowa to its final collapse, was essentially a middle western institution. While assemblies were held in every state, the greatest concentration was in the middle west and far west. The principal organizers of circuit Chautauqua were themselves middle westerners, and the whole movement was influenced by middle western community mores.

While the program of Chautauqua was based originally on educational and cultural presentations, a marked tendency existed, especially after 1920, toward popularization of the program in order to attract more patronage. Actually, however, this tendency served to alienate the class in each community which had supported Chautauqua, and in the end hurt the movement rather than aiding it. The commonly stated assumption that Chautauqua programs were based upon lecturers who dealt in inspirational platitudes but in reality said nothing, is actually untenable, by far the majority of Chautauqua lectures were informative in content.

Chautauqua was considered both as a business and a form of cultural expression. The study explores aspects of the business of several bureaus, and presents detail of bureau organization and operation, program choice, finance and merger. Even in the best years a major Chautauqua bureau became bankrupt, and several others proved unprofitable and were sold. After 1922 the Chautauqua business was,

financially, a precarious one; financial losses were often heavy. The theory that Chautauqua had its great year in 1924 is not supported by the findings. Throughout their existence, the circuit bureaus were subjected to frequent offers of financial aid by groups interested in gaining control of their platforms. No indication was discovered that any important bureau ever accepted such subsidy. While the bureaus did exercise a certain censorship it tended to be of a moral nature, and actually controversial subjects were often brought before Chautauqua audiences. Generally, the Chautauqua bureaus seem to have lived up to the assertion that they maintained a free platform.

During the First World War, the major Chautauqua bureaus took an active part in providing camp entertainment. Following the war they combined their resources to secure the repeal of a war tax on admissions through political maneuvering.

In regard to the community, the study deals with community attitudes, with the contract system, which was not always so disadvantageous to the community as has often been asserted, and with the factors and forces which brought the decline of Chautauqua.

Chautauqua brought to isolated communities a program of a much finer nature than any which they could have enjoyed without the circuits. Until the late days, when the program had been popularized, it appears as a genuine cultural and educational force. Even toward the end of the movement some attention was paid to the traditional cultural mission.

Appendices to the study list the names of seventy-one bureaus operating Chautauqua circuits, together with other information concerning them, and present data concerning the distribution of Chautauqua by states.

Microfilm copy of complete manuscript of 317 pages, $3.96. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1443.

A STUDY OF THE CAUSES OF FINLAND'S INVOLVEMENT IN WORLD WAR II AT THREE SEPARATE TIMES: NOVEMBER, 1939; JUNE, 1941; SEPTEMBER, 1944

(Publication No. 5676)

Bert R. Mortimer Heideman, Ph.D.
University of Michigan, 1952

Finland holds the unparalleled distinction that within the short space of six years, she had the League of Nations expel a state from membership within it for aggression committed against her, only to have a war guilt trial imposed upon her by the very state which had been expelled from the League of Nations. Finland fought three wars during World War II within the compass of six years — in 1939, in 1941, and in 1944. The purpose of this study is to seek the causes for the involvement of Finland in these wars and to determine whether Finland had any power of decision in the matter, or whether, regardless of the policies the men who tried to guide her destinies pursued, she would in any case have been drawn into the hostilities.

The principal sources for this study have been the twenty unbound volumes of the Finnish War Guilt Trial record which the author had exclusive permission to use at the Hoover Institute and Library at Stanford University. War trials are a new and unique historical phenomenon. The records of the trials, then, too, are a new and unique kind of historical material.

For the first war, there was the verdict of the League of Nations that Russia attacked Finland. For the third war, there were the condition precedent to an armistice with Russia in September, 1944, and the armistice, itself, which required that Finland not only break with Germany, but agree to intern or drive the Germans out of Finland. As Hitler would not withdraw the German forces from Finland, the Finns were compelled to take military action against them in order to secure peace.

The only one of the three wars concerning which marked differences of opinion arise as to its origins is what the Finns call the continuation war which began in June 1941. It is significant that in the Finnish War Guilt Trial of November 15, 1945, to February 21, 1946, the prosecutor refused to seek the causes for this second war further back than the fall of 1940 when the troop transit agreement with Germany to and from Norway was made.

The Finnish War Guilt Trial was forced upon Finland by one of the conditions of the armistice — Article 13. In its original form, it called for the apprehension and trial of war criminals. Apparently, there was not a sufficient basis for war crimes trials in Finland, and as the U. S. S. R. insisted that some sort of trial with a stigma attached be held in Finland, the basis for the trial was changed from a war crimes to a war guilt trial.

No matter how one weighs the steps taken by Finland or those which she might have taken, one is still impelled to the conclusion that the old Finnish saying portrays most accurately the situation: "Geography is our fate." Finland was in the middle; the powerful contestants would make the fateful decisions, which, in turn, would affect Finland no matter what course she pursued.

Microfilm copy of complete manuscript of 417 pages, $5.21. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1444.

THE FRENCH HUGUENOTS AND THE REVOLT OF THE LOW COUNTRIES AGAINST PHILIP II, 1559-1572

(Publication No. 5681)

Glenn John Hoffman, Ph.D.
University of Michigan, 1953

This study is concerned with the interaction between two great conflicts of the sixteenth century: the French Wars of Religion and the Revolt of the

Netherlands. It aims primarily at tracing the course of relations between the Huguenots and the resistance groups in the Low Countries, while determining in what respects they were related and how they influenced each other.

The basic premise applied was that the ties of a common religion, Calvinism, crossed national boundaries to unite minority groups in opposition to their rulers. The ties between the Protestant parties in France and the Netherlands, during the critical years from 1559 to 1572, are viewed in terms of hostile rumors and tentative plans, as well as in terms of common projects actually undertaken. In reconstructing the activities and plans of the insurgent groups, narrative histories and correspondence of the period were employed.

In the first three chapters the Protestants of France are shown to have an important part in spreading the doctrines of Calvin in the Netherlands, as well as a limited influence upon the formation of a party of political resistance there in 1566. The remainder of the dissertation treats the period during and following the Second and Third Wars of Religion in France, when the originally vague bonds between the two Protestant communities became firmer and more political in nature. This change seems to have been brought about primarily by the personal contacts of William of Orange and his followers with the French Protestant leaders. These relations reached their climax in plans for a joint invasion of the Low Countries in 1572 and were broken by the Massacre of Saint Bartholomew's Day.

The major conclusion reached was that events in France and the Netherlands were closely related during the period under consideration, with the Calvinist parties finally in 1571-1572 achieving a high degree of solidarity in a military alliance. The closeness of this alliance apparently resulted more from external pressures than from the positive affinity of a common religion. Concerted oppression by the rulers of France and the Low Countries constrained their Calvinist subjects to cooperate in political and military resistance. The most evident motivations for the alliance plan of 1571-1572 were William of Orange's desire for aid in his invasion of the Low Countries and Admiral Coligny's desire to strengthen his party and his king by cooperating in the project. The Massacre of Saint Bartholomew's Day was intended primarily to destroy the Protestant coalition; it accomplished its purpose.

Microfilm copy of complete manuscript of 281 pages, $3.51. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1445.

THE RELIGIOUS BASIS OF THE THOUGHT OF THE ELDER HENRY JAMES

(Publication No. 5477)

Dwight Wesley Hoover, Ph.D.
State University of Iowa, 1953

This thesis attempts to discuss the Elder Henry James' ideas in terms of his time. Special attention is paid to the theological predecessors of James, as his thought was concerned primarily with religious questions. Calvinist, Unitarian, and Transcendentalist religious thoughts are compared to indicate the relative concepts to which James had access. Swedenborgianism is also considered with emphasis upon the growing sectarian nature of the New Church.

James religious ideas are presented next. These are an advanced spiritual monism and a faith in the absolute sovereignty of God. Man's moral strivings to reach God are discounted; and an extreme distaste for personal spiritual pretensions is shown, best indicated by James' conviction that regeneration will include both good and evil men. James, however, did not assume that man's nature was evil, taking pains to assert that man's life, physical and moral, was good. Since James was an equalitarian, the sense of superiority was his greatest enemy, and his religious faith in the possibility of human nature was, in the author's opinion, quite similar to that of the thinkers of his time.

Microfilm copy of complete manuscript of 287 pages, $3.59. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1446.

THE SECTIONAL CONTROVERSY AND THE FRONTIER: PACIFIC NORTHWEST POLITICS ON THE EVE OF THE CIVIL WAR

(Publication No. 5898)

Robert Walter Johannsen, Ph.D.
University of Washington, 1953

The Pacific Northwest in 1860 was a young frontier region, sparsely populated and isolated from the East by poor transportation and communication as well as by two thousand miles of praries, deserts, and mountain ranges. The population of this far frontier had been drawn from all parts of the nation: the Midwestern farmer rubbed elbows with the New England merchant and business man and the "poor white" from the deep South. The Midwestern background, however, predominated and set the character for Pacific Northwest politics. The Mississippi and Ohio valley farmers had carried the principles of Jeffersonian agrarian democracy to their new homes in the Northwest. They also brought with them an aversion for political extremes, a religious devotion to the Union, and hatred for the negro race, and a passion for self-government. These elements, combined with the heterogeneity of the population,

produced a political conservatism that reached full expression during the sectional controversy.

A study of Pacific Northwest frontier politics on the eve of the Civil War illustrates not only the significance of national politics on the level of local frontier politics but also the consuming interest of the frontiersmen in the national upheaval of the sixties. At the same time, the isolation of the region and the conservative character of its politics resulted in the growth of a feeling of detachment from the national difficulties, a feeling that the region was merely a spectator to the war of the sections. The fact that the explosive issue of slavery expansion was practically inapplicable on this frontier allowed the early settlers to view the sectional crisis with a calmness that was lacking in other regions.

The slavery question was discussed in the Pacific Northwest in social and economic terms and finally settled by an attempt to exclude the negro race altogether from the region. Popular sovereignty, more than just a political principle on this frontier, was considered the wisest and most just way of settling the sectional conflict. Broadly interpreted to mean full and complete territorial self-government, popular sovereignty was the principal issue of the election of 1860. Republicans and Douglas Democrats united in support of popular sovereignty and expressed their agreement by coalescing on the local legislative level. During the secession crisis, Pacific Northwest frontiersmen strongly advocated compromise as the only escape from the destruction of the union. Coercion as a remedy was universally denounced. The firing on Fort Sumter was followed by enthusiastic support of the national administration, although some elements still insisted on following peaceful measures toward a reunion of the sections. The conservative nature of Pacific Northwest frontier politics resulted in an avoidance of the two extremes represented by the Northern abolitionist and the Southern "fire-eater" and in an almost religious devotion to the Union "as it was." Thus, during the sectional controversy, the Pacific Northwest assumed the role of a transplanted "border state."

Microfilm copy of complete manuscript of 495 pages, $6.19. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1447.

THE HYDRAULIC MINING CONTROVERSY IN CALIFORNIA, 1856-1895: A CASE STUDY IN SECTIONALISM

(Publication No. 5800)

Robert Lloyd Kelly, Ph.D.
Stanford University, 1953

After the initial gold mining period in California, during which miners worked and nearly exhausted stream placers, large numbers of miners turned to the working of Tertiary gravel deposits, which contained vast amounts of thinly distributed flake gold. The hydraulic mining process was developed, whereby powerful streams of water were played upon the hillsides, washing auriferous gravel through long tunnels and sluice-boxes to recover the gold, and depositing immense quantities of mud and gravel in the rivers, to be washed out of the mountains and spread upon the Central Valley. Large corporations were formed, extensive water systems were built, and a more complex society supplanted the simpler organization of the placer period.

As a result of hydraulic mining, debris filled the river channels. It seriously restricted navigation in the lower rivers, heightened flood dangers, and buried thousands of acres of farm lands under vast sheets of infertile sediment.

The farmers protested bitterly. In 1873 they sued one large mine for damages, but failed because its debris was indistinguishable from that of other mines. In 1876 the farmers urged the State Legislature to initiate an investigation of the problem, but their plea was turned down. The rest of the State was indifferent to the situation and preferred to vote with the mining counties. The miner was still a figure of pre-eminent importance.

The farmers organized a formal, standing organization — one was eventually formed of the Boards of Supervisors of the valley counties — and continued their efforts, both in the courts and in the Legislature to protect their interests. An attempt in 1879 to enjoin all of the mines in one watershed failed when the State Supreme Court ruled that such an action was misjoinder of parties. The farmers succeeded in 1878 in persuading the Legislature to investigate the problem, and out of this grew the Drainage Act of 1880, the first effort at large-scale reclamation undertaken by the State of California. A system of debris dams and levees was constructed at great cost, in the hope that mining debris could be controlled without outlawing the industry. But the rest of the State violently opposed the state-wide tax imposed to finance the project. Debate over the Act deadlocked the Legislature of 1881. Eventually, the courts invalidated the Act as unconstitutional.

With all hope of an amicable settlement thus lost, the farmers turned again to the courts. In a series of protracted litigations they succeeded in persuading the courts to reverse the earlier decisions which had prevented success, and won a series of increasingly definitive court victories. In 1884 the United States Ninth Circuit Court issued a perpetual injunction against the discharging of debris by a group of large mines on the Yuba River.

From this point the controversy became a grim searching-out by the farmers of all hydraulic mines in the Sierra Nevada, and the institution of injunction proceedings whenever one was discovered. The miners fought back tenaciously for several years, using every means short of force to continue their operations. Congress in 1893 passed an act allowing them to continue if they impounded their own debris, but this proved impractical. By 1895 the hydraulic mining industry, and the society founded upon it, was dead. The farmers had consolidated their position as the pre-eminent group in California.

This controversy is here presented for the first time as the subject of a scholarly examination. Since only brief mentions of the controversy exist in secondary works, the great bulk of the information upon which the study was based — at least 90% — was drawn from newspapers of the period.

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THE FRENCH IN INDIANA, 1700-1760: A POLITICAL HISTORY

(Publication No. 5869)

Frances Krauskopf, Ph.D.
Indiana University, 1953

The significance of this investigation lies more in the direction of synthesis and of fitting new details into a familiar framework than in supplying an entirely new picture of the French occupation. Although many facts have been uncovered to fill in the picture, the records are so insufficient that the general conception is often hazy and at many points one is unable to determine what actually happened.

French civilization in Indiana center about three tiny posts, Miami, Ouiatanon, and Vincennes, none of which ever reached first-rank importance, even though many officials thought the Wabash valley was the key to French security. By and large they were founded to prevent English expansion into the Wabash valley. But while the immediate causes for their establishment were a mixture of political and imperial motives, these factors were in turn based on the necessity of protecting the colony from Indian warfare. And the chief factor in keeping the savages at peace was a continuous and liberal supply of necessities, trinkets, and liquor — herewith entered the economic motive. Undoubtedly many a trader eyed this business from the viewpoint of his own selfish gain.

Miami and Ouiatanon, founded in 1717 and 1721 respectively, belonged to New France and were primarily fur-trading posts. But Vincennes, established in the early thirties by Louisiana, became the home of habitants who conducted a kind of agriculture.

French civilization left few abiding influences in this area. Its principal contributions lay in exploring and mapping and in initiating the forces which led to the ultimate downfall of the Indians. Knowledge of French discoveries and investigations filtered through to the English settlers and the home government. The whites brought the savages not only such useful items as kettles, guns, powder, lead, knives, and clothing, but also the diseases and liquor which annihilated hundreds of them — far more, probably, than were ever killed in actual warfare. Although in the Wabash valley these plagues were introduced by the French, they were a concomitant and inevitable part of the clash of the two civilizations.

In these early years the Indians noticed little difference in the ultimate goals of either nation. Both could supply his needs, and his unstable affections went to that which furnished him the best goods at the lowest price. In the Indian area there is certainly no evidence that the French were much more adept or successful than the English in their treatment of the savages.

Life at the French posts was a dreary round of day-to-day encounters with childlike savages who could never be trusted, either at hand or out of sight. Occasionally news from the outside world filtered through; but rumors were so rampant that one was never quite sure what to believe. When one analyzes the motives which induced a civilized man to remain in such surroundings, one is increasingly impressed with the comment that only the hope of profit could make such an existance endurable.

Microfilm copy of complete manuscript of 413 pages, $5.16. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1449.

THE LIFE AND POLITICS OF HENRI, COMTE DE PARIS

(Publication No. 5847)

Samuel Maurice Osgood, Ph.D.
Clark University, 1953

Henri, Comte de Paris (born in 1908), pretender to the French throne, is an intelligent, democratic man possessed of a keen knowledge of social, political, and economic problems. Charged with the direction of royalist propaganda by the Duc de Guise, his father, he made a serious attempt, from 1934 to 1939, to organize the royalists of France into a nationwide propaganda network. In these same years he developed doctrines which led him to advocate the restoration of an authoritorian monarchy based on a corporative system wherein capital and labor would meet on equal terms. The plight of the working classes of France was then, and continues to be, one of the prince's chief concerns.

A noteworthy incident of this early period was the Comte de Paris' repudiation of the Action Française, long the leading exponent of royalism in France. This break was caused by the prince's realization that his concept of the monarchy differed on many points with the dogmatic doctrine of integral nationalism developed by Charles Maurras, the movement's leader. Further, he objected to the violent methods of the Action Française. While this rupture gave the Comte de Paris greater freedom of action, his efforts to revive royalism in France never rallied more than a pitifully small minority of the population. The country was no nearer to a monarchial restoration when the Comte de Paris' efforts were interrupted by the outbreak of the Second World War, than it had been when he had begun his campaign four years earlier.

The Comte de Paris, who had served briefly as a private in the Foreign Legion, moved to Morocco after France's defeat. His orders to the royalists of France were to resist the Germans in the occupied zone, and to rally around Marshall Pétain in the unoccupied zone. He maintained this attitude toward the Vichy regime until November, 1942. A proposal to replace the Darlan regime in North Africa by a provisional government of national union headed by the Comte de Paris gained some momentum among the French in December, 1942, only to be discarded when the American authorities on the scene categorically vetoed the project.

The postwar period was to mark a drastic change in the positions held by the Comte de Paris. He now regards true parliamentary democracy as the only alternative to a dictatorial solution of the right or the left, and as the only means to preserve individual liberties in France. He has also reduced the monarchical concept to a symbol of national unity and love — a symbol which he argues the French have long needed. The pretender has abandoned all attempts to organize the royalists and addresses his monthly messages to all Frenchmen without distinction. He is not actively seeking to regain the throne, but stands ready to answer his compatriots' call should they ever be in need of the services of an arbitrator King.

The Comte de Paris returned to France in July, 1950, following the abrogation of the Law of 1886 which formally banished from French soil the heirs of former ruling families. His consistent backing of the Third Force has served to place him on amicable terms with the leaders of the Fourth Republic. The chances that he might someday be called upon appear very slim at the present, but there is a strong possibility that he may gradually come to assume the role of an elder statesman.

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PRINCESS OF THE SERTÃO: A HISTORY OF FEIRA DE SANTANA

(Publication No. 5812)

Rollie Edward Poppino, Ph.D.
Stanford University, 1953

Feira de Santana in the State of Bahia lies in that zone where the lush coastal region fades into the vast semi-arid hinterland. Its historical role has been to tie the coast and the hinterland together. In this respect it is similar to many towns of the great Brazilian bulge. The thing that distinguishes Feira de Santana is that it continued to fulfill its function equally well as Brazil passed from one form of transportation to another, until today Feira de Santana has become the major transportation hub of northeastern Brazil.

The municipality first came into prominence when it became the great feira or fair to which cattle herds were driven as much as a thousand miles to be sold and fattened before being delivered to Salvador for slaughter. It met the challenge of neighboring towns when steamers were introduced into the bay, and later when railroads were pushed into the interior. Within recent years, the selection of Feira de Santana as the focal point of an expanding modern highway system assured its continued growth and permanently established its role as a transportation center.

Feira de Santana now has a population of over one hundred thousand, as compared with approximately twenty thousand a century ago. As the municipality has grown, the racial composition has changed. The Indian and mestizo have been replaced by the Negro and mulatto, and the number of persons of European descent has dropped from about 30 per cent to an estimated 10 per cent of the total population. However, there has been little change in economic classes, with the Negro continuing to occupy the lower rungs in both cases.

Today the town exercises considerable local autonomy, but this has not always been true. Under the Empire its government was controlled from Salvador and during the Vargas regime, 1930-1945, popular government disappeared entirely. The citizens of the municipality still show the effects of outside control. As late as 1950 many who had the privilege of voting did not trouble to cast their ballots, and 12 per cent of the population chose the municipal administration. The city fathers, as in the days of the Empire and Vargas, show a strong propensity to look to the state for advice and financial assistance.

Although education and social welfare institutions in Feira de Santana may be considered good as compared with conditions existing in other towns in the interior of Bahia, they still leave much to be desired. In 1950, it appeared that the correction of these deficiencies would have to await funds from either the state or national government, as the problem seemed to be beyond the resources of the local citizenry. In this respect Feira de Santana is not unlike the vast majority of Brazilian municipalities.

It is perhaps too early to establish the future economic position of Feira de Santana beyond that of a transportation center, but it appears that, despite the handicaps of a limited market and inadequate industrial power, industry will assume an increasingly important role in the municipal economy. The surrounding area has been diversified agriculturally and there are large quantities of farm products suitable for processing. Industrial processing of tobacco, cotton, and vegetable oils is well established in Feira de Santana.

In spite of the problems facing industry, municipal leaders foresee only growth and prosperity for Feira de Santana. The municipality still boasts the largest cattle fair of Northern Brazil, while the remarkable rise of industry and commerce indicates that Feira de Santana will continue to occupy an important place in the economic life of Bahia.

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JOHN TYLER MORGAN, AN EXPANSIONIST SENATOR, 1877-1907

(Publication No. 5907)

August Carl Radke, Jr., Ph.D.
University of Washington, 1953

John Tyler Morgan served as United States Senator from Alabama from 1877 until his death in 1907. His thirty years service in the Senate began with the reunion of the sections and ended with the United States established as a world power. The expansionism of the 1890's differed in some respects from that of the decade a half century earlier. Whereas the Expansionists of 1848 had been concerned with the acquisition of practically uninhabited territory within the continental United States, the Expansionists of 1898 looked to the islands of the Pacific and of the Caribbean where large populations of different races lived. To the leading group of American expansionists of the 'nineties, like Admiral Mahan, Theodore Roosevelt, and Henry Cabot Lodge, must be added John Tyler Morgan.

Morgan was born in 1824 in Tennessee, and nine years later the family moved to Alabama. After only three years of formal schooling, Morgan's education was continued by his mother. In 1845 Morgan was admitted to the bar. He first came to political attention during the Democratic state convention in 1859 and Alabama's secession convention in 1861 as a trusted lieutenant of William L. Yancey, the foremost southern advocate of secession. After Sumter, Morgan enlisted as an infantry private, and became a Brigadier General by the war's end. He served competently, but not brilliantly, both as an infantry and a cavalry officer. During Alabama's Reconstruction, Morgan advised caution and the acceptance of the results of the war.

In the United States Senate Morgan was a conservative, states' rights, Southern Democrat, and he assumed a leading role in that group. He opposed the enactment of legislation which sought to increase federal power at the expense of the states, as for example, the Blair bill and the Force bill. The Senator also believed that a combination of state authority and the courts, rather than the Federal Government, would suffice to regulate business.

With the enactment of the Bland-Allison bill Morgan accepted "free-silver," and became one of the active silver Senators. Morgan's stand for silver brought him into contact with the Populist revolt, although he never left the Democratic party to join the Populists. He assisted the Democratic party in Alabama to resist successfully the challenge in the 'nineties of the combined forces of the dissident Democratic farmers, Populists, and Republicans.

A states' rights Democrat on domestic legislation, Morgan was an American nationalist in American foreign relations. His American nationalism was as fervent as had been his Southern nationalism. Morgan combined his nationalism with an ardent desire for American overseas expansion, to fulfill the destiny of the United States to become a world power. As a member of the 1893 Bering Sea Fur Seal Arbitration Tribunal, he dogmatically upheld the American case, in spite of contradictory evidence.

Morgan's expansionism found him among the leaders for Hawaiian annexation and American intervention in Cuba. Foremost among Morgan's expansionist activities , however, was the Nicaraguan Canal. From his first interest in a Nicaraguan Canal in 1886, Morgan fought with great zeal for two decades for a Nicaraguan Canal. Morgan and the Nicaraguan Canal became inseparable, and much credit for an American isthmian canal belongs to Morgan. Despite the decision to build at Panama, one of Panama's most outspoken advocates, John Spooner of Wisconsin, in a Senate speech conferred upon Morgan the title, "Father of an isthmian canal."

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THE EMERGENCE OF THE WHIG PARTY IN THE NORTH: MASSACHUSETTS, NEW YORK, PENNSYLVANIA, AND OHIO

(Publication No. 5613)

John Julius Reed, Ph.D.
University of Pennsylvania, 1953

Supervisor: Roy F. Nichols

The aim of this dissertation is to present the circumstances under which the American Whig party emerged in Massachusetts, New York, Pennsylvania, and Ohio in the early 1830's. National questions, which during this period were of diminishing importance in producing a basis for party alignments, are treated only when operative as divisive factors in these states. Presidential politics, however, are analysed at some length because at this time they constituted for the Whigs more of a state than a national question. This analysis is based on an examination of contemporary newspapers, correspondence, published and unpublished, of leading political figures, and on important secondary materials.

This essay begins with a survey of social and economic factors in each of the four states during this period of rapid change and with presentation of major political developments from the War of 1812 through Jackson's first administration, including an analysis of the returns from the elections in 1832. Succeeding chapters analyse efforts of the anti-Jacksonians to recoup losses, to attain success in 1834 and 1835, and the nature of gains and losses in 1836. A

discussion of how Antimasonry, a political labor movement, and, finally, the Whig idea in turn affected political groupings in the several states is included. In analysing the impact of workeyism and of Antimasonry this study shows how these enthusiasms worked themselves out in distinct state situations, each in a different way. Similarly, the old and revered concept of Whiggery was also applied in a different way in each of the different state situations. Emphasis is placed on the federal nature of the American party system and on demonstrating how the states, then as now, constituted an important part of what is essentially a tri-dimensional party situation. This paper demonstrates how a great deal of political activity in the early 1830's centered around neither principle nor action conducted on a national scale but about the very practical goal of controlling the government of the states.

In Massachusetts, the National Republicans, building on Federalist foundations, had never really lost power. Whiggery was used to ward off Democratic attacks. This was possible for several years but workeyism, Antimasonry, and Jacksonism had a corroding influence which soon would produce the disintegration of the Whigs. In New York a People's Party had revived Clintonism as a political weapon but the latter died with its leader. Workeyism and Antimasonry proved ephemeral and Democratic control of the state, strengthened by the political organization known as the Regency, by Martin Van Buren's ambitions, and by Jackson's name, seemed unchallengeable. The Whig idea was resurrected here to strike at the Regency. Success was not attained by 1836 but the Whigs had built a party with capable leaders, a press, and good organization.

In Pennsylvania, factionalism was chronic and Antimasonry for years led the opposition to the Jacksonians. The Whigs, during the early 1830's, were little more than another faction and achieved success only through coalition with the Antimasons. In Ohio, and in the Northwest generally, a period of personal politics persisted into the 1830's. Politics remained in the doldrums and the political pendulum swung to and fro between amorphous groupings. A statewide rally on John McLean proved abortive but by 1836 Ohio Whigs had an improved organization and had found in William Henry Harrison a useful weapon against the Jacksonians.

The depression which would break in 1837 was to provide a golden opportunity for the Whigs, but, as this study of the emergence of the northern Whigs shows, their political behaviour assuredly would continue to be the product of distinctive patterns in the states.

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THE IMPACT OF THE FRENCH REVOLUTION AND NAPOLEON UPON THE UNITED STATES AS REVEALED BY THE FORTUNES OF THE CROWNINSHIELD FAMILY OF SALEM

(Publication No. 5932)

John H. Reinoehl, Ph.D.
Michigan State College, 1953

The years between 1792 and 1815 were troubled years for Europe. The French Revolution had brought internal strife to France, which had spread rapidly until it involved the whole of Europe in revolution and war. Across the Atlantic the United States, enjoying the first fruits in independence, was in a position to be affected as a neutral power by conditions in Europe. The purpose of this study has been to trace the impact of those years in Europe upon the United States.

The vehicle for tracing this impact has been the Crowninshield family of Salem, Massachusetts. The Crowninshields were selected for this study because they were active and important in the two areas most apt to reflect European influences of that time — economics and politics. As major shipowners and merchant-captains they dealt directly with Europe throughout the years between 1793 and 1815. In the political field they provided a Jeffersonian Congressman and a Secretary of the Navy to the national scene and were also in the very center of the political hotbed of Salem.

Economically, the Crowninshields became significant as a result of commerce generated by European wars. Their commerce was regulated by European rulings. Decisions on neutral shipping from Paris and London made their shipping profitable or unprofitable, dangerous or safe, and even determined its destination. Crowninshield shipping closely parallels the general pattern shown by shipping statistics for the entire United States and therefore is illustrative of the impact of European events upon the commerce of the entire United States.

The Crowninshields prospered greatly during the war years between 1793 and 1801. This prosperity was interrupted by the Amiens peace, 1801-1803. With the renewal of war, American commercial prosperity again built up until the peak year was reached in 1807. The European powers began to enforce their restrictions on neutral shipping in the late summer of 1807, and with that enforcement, United States commerce quickly became too dangerous to continue. The American Embargo Act was passed in December, 1807.

Crowninshield experience places Jefferson's Embargo in a favorable light. The merchants of America had discovered the difficulty of coping with the European bans on commerce and had voluntarily restricted their shipping prior to the passage of the Embargo. When they rushed to sea after the lifting of the Embargo in 1809 they lost the wealth they had built up over the years.

This study further indicates that French measures and actions, which were less predictable and less honest in operation than those of the British, were the more harmful.

Politically, there is nothing to indicate any doctrinal influence of Europe on the Crowninshields

or Salem. Names of French revolutionary groups provided terms for vilification in Salem, but the Crowninshield papers do not indicate a doctrinal kinship between the "Jacobins" of Salem and their French namesakes. Those terms, however, served to intensify the differences between the two major political groups in Salem. Political differences were indigenous, based upon previous biases, rather than upon French Revolutionary doctrines.

Microfilm copy of complete manuscript of 269 pages, $3.36. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1454.

ROBERT TREAT PAINE AND HIS PAPERS

(Publication No. 5849)

Stephen Thomas Riley, Ph.D.
Clark University, 1953

The Papers of Robert Treat Paine, the Signer of the Declaration of Independence, were given to the Massachusetts Historical Society in 1940. Since the Society has contracted to publish the more important documents, it has seemed advisable as a preliminary step to make a calendar of the Papers and furnish a brief account of their scope and relative importance.

The collection consists of thirty-five volumes of manuscripts spanning the period 1660-1862. The great bulk of the Papers falls in the period of Robert Treat Paine's lifetime, 1731-1814. In addition to the Signer's Papers there are smaller collections of manuscripts of Thomas Paine, the father of Robert Treat Paine, and of the important Cushing family. This family numbered among its members William Cushing, the justice of the United States Supreme Court.

There are practically no manuscripts in the collection dealing with Paine's pre-college years. His years at Harvard from 1745 to 1749 are well documented and his correspondence, diary and college writings throw new light on school life in the mid-Eighteenth century.

Upon leaving college Paine engaged in a number of pursuits before settling down to the study of law. In quick succession he tried his hand as a school teacher, sea captain engaged in small loading ventures, whaler and finally army chaplain. The researcher interested in those occupations will find much pertinent information in the Papers for the period 1749-1756.

After studying law under the famous Benjamin Pratt, Paine was admitted to the Bar in 1757. He spent a few years in Boston, then moved to Taunton in 1761. There by reason of hard effort and great natural ability he soon rose to the top level of his profession. Before long he had as clients some of the more important people of Massachusetts. There is little in the Papers to reveal Paine's political thinking at this time. It was not until 1768 that he began to appear as Taunton's representative in the General Court.

Paine's name became known throughout the colonies when he acted as prosecutor in the Boston Massacre trials. His activities against Governor Thomas Hutchinson and Chief Justice Peter Oliver further stamped him as a loyal patriot, and he was rewarded by being named a delegate to the Continental Congress where he served from 1774-1776. He was re-elected in 1777 and 1778 but did not take his seat, preferring to devote his time to state business. He cannot be called one of the outstanding members of the Congress but he did do extremely useful work. He devoted most of his time to committee work acting as Chairman of the Salt-Petre, Cannon and Firearms committees. His Papers are extremely rich for this period and reveal some of the dissensions that were splitting state delegations.

Soon after Paine's return to Massachusetts he was appointed Attorney-General. He served in this office from 1777 to 1790, and it was his duty to supervise the confiscation of Loyalist estates and prosecute the leaders of Shays' Rebellion. He played an important role in the adoption of the Massachusetts Constitution of 1780 and was a delegate to the State Ratifying Convention of the Federal Constitution in 1788. Paine's conservatism, which became evident from 1777 on, and the duties of his office did not conspire to increase his popularity. It was with some relief that he resigned his post in 1790 to accept a Judgeship on the Massachusetts Supreme Court which he held until 1804. The last ten years of his life were spent quietly. He died in 1814 after having devoted some thirty faithful, but somewhat unappreciated, years in the public service.

Microfilm copy of complete manuscript of 369 pages, $4.61. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1455.

THE INFLUENCE OF RIVERS IN THE DEVELOPMENT OF RIO GRANDE DO SUL, BRAZIL

(Publication No. 5814)

Rolland C. Rogers, Ph.D.
Stanford University, 1953

"Every human enterprise is the mixture of a little bit of humanity, a little bit of soil, and a little bit of water." Of the trio, water has been the dominating factor in the history of Rio Grande do Sul. For nearly two hundred years the fluvial-lacustral system provided the major arteries of trade and travel and as recently as 1950 this network carried more than 40 per cent of the total inland waterway cargoes of Brazil. The excellence and the extent of the only "actual fluvial network" in the nation dictated the construction pattern of both highways and railroads. Satisfactory transportation in the chief traffic producing regions allowed Rio Grande do Sul to limit railway building in those areas and to indulge in the luxury of constructing rail lines in those parts of the state which have a low cargo potential. Highway building, however

has been concentrated in the river-served districts because the greatest source of traffic is found there.

It is natural that rivers should determine the original settlement pattern, and, by concentrating one-fourth of the population in three river valleys which comprise less than one-tenth of the total area of the state, the waterways also decreed that small properties devoted to general farming would dominate the state economy. Furthermore, the rivers made possible cheap bulk transportation so necessary to the profitable production of such crops as rice, wheat, and timber.

Control of the shipping industry was first concentrated in the hands of Luso-Brazilians but after the Farroupilha Revolt (1835-1845) leadership in inland navigation passed to Teuto-Brazilians, who in turn created the "Age of the Paddle Steamer." In little more than half a century these German entrepreneurs developed the most extensive nonsubsidized shipping industry in Brazil and by the first decade of the twentieth century an attempt was made to consolidate the entire river trade in the hands of the four leading operators. The scheme did not succeed but it served as a pattern for later attempts to prevent internal competition.

During the past four decades river and lake shipping has operated under increasingly serious handicaps which threaten its very existence. Airline and highway competition, governmental regulation and red tape, discriminatory taxation, inadequate channels and docks, and an antiquated fleet have stripped the watercourses of most of their importance as media of communication. Unless the situation is quickly corrected river shipping is doomed to disappear in Rio Grande do Sul.

To remedy the present unsatisfactory conditions three major reforms must be effected. First, the present fleet must be replaced by modern, streamlined equipment embodying the latest engineering discoveries and practices. Second, discriminatory regulation and taxation must be repealed. Finally, the government must adopt a comprehensive plan for the development and utilization of the total waterway resources of the state. Although the preponderant influence of rivers on the history of Rio Grande do Sul has been based upon transportation, the blueprint for future use must include hydroelectric power and irrigation projects. It is quite possible that the greatest waterway contribution will be made in these latter fields.

This is the first monographic study to deal with the vital but neglected waterways of Rio Grande do Sul. Written after a year of research and travel in Brazil, it is based upon information gleaned from manuscripts, official documents, engineering studies, and newspaper accounts found in archives and in public and private libraries located in Rio de Janeiro and Pôrto Alegre. These sources were supplemented by the personal observations of the writer and by interviews with government officials and various members of the shipping fraternity in Rio Grande do Sul.

Microfilm copy of complete manuscript of 318 pages, $3.98. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1456.

THOMAS WILSON, TUDOR SCHOLAR AND STATESMAN

(Publication No. 5620)

Albert J. Schmidt, Ph.D.
University of Pennsylvania, 1953

Supervisor: Conyers Read

Thomas Wilson was one of those Elizabethans who had such a varied range of interests and abilities that he was limited in the extent to which he could achieve expertness in any particular one. His classical training in the manner of the New Learning proved him a better than average scholar. If he were not a Smith, Cheke, or Ascham, he at least ranked on the level immediately below them; while the books he wrote on logic and rhetoric most certainly found readers who never had the opportunity of hearing his brilliant Cambridge colleagues. His essay on usury pointed to the breadth of his understanding of the complicated workings of the foreign exchange. At Cambridge he received more than a grounding in fundamentals: his study of the classics there prepared him adequately for the career in civil law which lead directly to his political preferment; there also he became fully imbued with the doctrines of the Continental religious reformers. His Cambridge experience with the Martin Bucer group and his common bond with others who shared Continental exile during Mary's reign made him throughout his life a strong proponent of Calvinistic purifications within the church.

Wilson's political career was not outstanding in itself, but when considered along with his other accomplishments it loomed larger than its true value. He used his training in the civil law and his friendship with the Dudleys as stepping stones to the political heights which he achieved. Starting first in the courts, the Arches and Requests, he graduated to diplomatic missions to Portugal and the Low Countries, the House of Commons, and eventually shared the secretaryship with the great Walsingham.

Wilson's instruction in the humanistic tradition and the civil law left him on domestic affairs a staunch political conservative who viewed the Tudor commonwealth in much the same light as More or Starkey had a generation before him. His obsession with the preservation of the commonwealth coupled with a violent anti-Romish feeling made him a useful servant of the Elizabethan monarchy. He was a willing rack-master, a loyal servant of the crown in the Commons, and while on diplomatic missions an unusually keen observer and an industrious correspondent. While on his embassies he showed determination and callousness by his relentless pursuit of the Catholic refugees. So suspicious did he become

of the Spanish governor Don John that he appeared to take it upon himself to shape the queen's policy in the Netherlands. If she nodded toward Orange, Wilson established himself to such an extent as a partisan of the prince that he was actually accused of plotting the overthrow of Don John.

Once he had returned to England and won for himself a position of some influence, he continued to exert his efforts on behalf of the Continental Protestants, Orange and Casimir. When it seemed to England's advantage, he favored the Alencon marriage and championed the support of Don Antonio, the Portuguese pretender. All of these aspects of his policy, designed to preserve the commonwealth, succumbed to the queen's close watch over her purse.

The reward Wilson received for his efforts were not meagre. He had a considerable income from the mastership of St. Katherine's Hospital and was, shortly before his death, appointed dean of Durham. Much of his wealth centered around his estate at Edmonton in Middlesex.

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BRITISH REACTION TO THE SOVIET UNION, 1924-1929: A STUDY OF POLICY AND PUBLIC OPINION

(Publication No. 5876)

Theodore King Shane, Ph.D.
Indiana University, 1953

Although an Anglo-Soviet trade agreement had been signed in 1921, British de jure recognition of the Soviet government came only after the first Labor ministry took office in 1924. An Anglo-Soviet conference then convened to arrange a settlement of the outstanding differences between the two governments, and a general treaty and a commercial and navigation treaty resulted. The former was attacked by leading Liberals because it provided for a guaranteed loan to the Soviets after British claims against Russia had been met. Without Liberal support the treaty was doomed.

In October the Labor ministry received an adverse vote on a minor issue and Prime Minister Mac Donald chose to go to the country. Shortly after the election the foreign office protested to the Soviet government against a document purporting to be a letter from the head of the Communist International, Zinoviev, to British Communists, advising them to prepare for revolution. Conservatives charged that the letter proved the futility of Labor's settlement with Russia and the dominance of the Labor Party by its extremists who, claimed the Conservatives, received their orders from Moscow. MacDonald with matchless inconsistency claimed that the publication of the document demonstrated the efficiency of Labor administration and at the same time claimed that the foreign office had acted without his authorization. Although further information bearing on the affair came to light in 1928, the question of the authenticity of the letter remained unanswered. The election of 1924, however, resulted in a smashing Conservative victory.

The return of Conservative government spelled the doom of the treaties of 1924, and the Anglo-Soviet relations continued on the basis of the trade agreement of 1921. Such relations seldom were without strain. The Conservative government repeatedly complained of Soviet interference in British interests and of anti-British propaganda, while for their part the Soviets pointed to statements of Tory Die-hards to show the existence of a British threat to their security. The tension reached a climax in May, 1927, when police raided Arcos, a Soviet trading company in Britain, in search of a document stolen from the war office. Although the document was not found at Arcos, the British government asserted that other evidence discovered there and elsewhere justified breaking relations with the Soviet Union and forthwith took that step.

Anglo-Soviet relations were not resumed until the second Labor government took office in 1929. In October of that year the two countries signed a protocol which established the procedure to be followed in settling the questions outstanding between them. This was approved by the House of Commons in November, and in December, 1929, ambassadors were finally exchanged.

This study is not confined to an account of the changes in British official policy toward the Soviet government. It seeks in addition to describe British popular reaction to these changes. For this purpose the author has availed himself of editorial comments in British newspapers of varying political views, editorials and innumerable articles in British periodicals, and reports of speeches made not only in Parliament but in public meetings throughout the kingdom.

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STUART PATERNALISM AND THE MANUFACTURE OF NEW DRAPERY IN COLCHESTER AND NORWICH, 1603-1640

(Publication No. 5498)

Ernest F. Sixta, Ph.D.
State University of Iowa, 1953

This dissertation centers on the economic role of the State in the manufacture of new draperies in England from 1603 to 1640. The new draperies were one of the most important cloths produced in England during the reign of the Early Stuarts. They are, therefore, a key to the economic problems of the period. The analysis includes three subordinate problems: The importance of local authorities in economic administration; the extent to which the

government followed an economic policy; and the validity of King James I expressed claims to a benevolent paternalism.

The study is based on printed government documents, proclamations, and the decrees and orders of the Privy Council. The above plus original manuscripts such as the State Papers, records of the Court of Exchequer and Star Chamber and the collections found in the British Museum constitute the major sources used to determine the economic role of the State.

The role of the State, as determined from the records of the Central government, was tested by investigating the industrial practices of Colchester and Norwich. The local study is based on the Assembly Books and Court Books of Colchester, the various collections found in the Muniment Room of Norwich Castle and the Essex Sessions Rolls in the manuscript room of the Chelmsford Town Hall, Essex.

The alien refugees who fled to England from the Low Countries played a major part in the production of the new draperies. In addition to the sources already mentioned the local records kept by the refugees are the basis of the analysis of the economic and social problems created by the refugees.

The first four chapters treat the over-all problem of Stuart Paternalism and the cloth industry. Chapter I describes the structure and principles of the period. Chapter II explains the role of the middlemen, the clothiers and merchants in the existing economic structure. Chapter III centers on a discussion of the principles of paternalism applied to the cloth industry and Chapter IV applies the same principles to the cloth workers.

The second part of the dissertation centers on a discussion of the production of new draperies in light of the existing economic structure, principles and people involved in the industry. Chapter V centers on the problems created by the new industry for the State. Chapter VI describes the economic and social problems as they existed in Colchester and Chapter VII describes these problems in Norwich.

Six major conclusions can be drawn from this study. First, there was throughout the period an absence of anything that might be called a positive economic policy. In so far as a policy did exist, it was negative. Secondly, the State did consciously attempt to direct industry. However, State control was incoherent and self-contradictory. Above all, it was inherited. Third, the Stuart government constantly modified the industrial code to meet the forces working for change. Fourth, the regulations that were enforced were the product of local practices and interests. The local officials were the enforcing agency. Fifth, circumstances dictated the practices of the government of the Early Stuarts. Sixth, the pressure of circumstance forced the State to enlarge the area of competition.

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THE IMPERIAL GERMAN NAVY, 1910-1914

(Publication No. 5881)

James Edward Sutton, Ph.D.
Indiana University, 1953

The Imperial German Navy bulked large in German foreign and domestic policies. In Anglo-German relations, it was the problem which overshadowed all others. Domestically it was less important. Though supported by powerful propaganda agencies, its ambitions remained secondary to those of the Army, a fact revealed by relaxation of naval demands after 1912.

The reputation of the navy has been derived from Anglo-German relations. For the first time since the late 'eighties, Great Britain found herself faced by a naval rival who could be made to appear dangerously aggressive. This point was hammered home by the partly contrived Naval Scare of 1909, a phenomenon which convinced many Germans of British perfidy. It painted a lurid portrait of the German Navy which has persisted to this day.

It is a caricature. The German Navy was much less aggressive than the British were led to believe. Its officers even felt a kinship to their counterparts in the Royal Navy which had provided the model of the German Navy. This sentiment did not obliterate German fears that war between the two services was somehow inevitable. If anything, it re-inforced belief that the British Navy was nearly invincible on the high seas.

Meanwhile, German technicians prepared the fleet which might fly the imperial banner into action. They were often successful. Their ships and equipment were peers of any afloat, though German designers appeared to imitate and therefore lag behind the British. In some areas of technological development they were not so successful. When such failures are open for investigation, they appear to have stemmed from German doctrinairism. It was particularly marked in the matter of ordnance, where the Germans maintained interest in guns firing smaller, lighter high-velocity projectiles even as the other naval Powers strove for larger, heavier, slower shells. Eventually the Germans accepted the latter — with reservations. It was then too late: German ships of all classes had to fight the war with weapons of excellent though lesser quality. The whole gunnery issue was enveloped in the same inhibitory doctrinairism. Though the Germans had astounding instrumentation for long-range gunnery, it never achieved the same acceptance as did torpedo practice. The Russo-Japanese War had, in effect, confirmed an older German belief in the efficacy of that weapon. Convinced before they appraised, the Germans failed to recognize the Japanese successes as tours de force, probably never to be repeated by surface craft. The submarine, which might have done the job, progressed rapidly, though belatedly. In general, however, the German Navy was equal to the British in all capacities except numbers of ships to be deployed.

There was the rub. The Germans were bluffed by British naval tradition into expecting a sudden violent

attack by the larger British fleet. They prepared to meet in the "Wet Triangle," where their mobile fleet would have support from static defenses on Helgoland and the mainland. Their ambitions went no further. When such an attack did not occur, the naval war became one of marked staticity, unrelieved by the adventitious encounter off Jutland or the nearly successful improvisations of submarine warfare.

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RESPONSIBLE GOVERNMENT IN THE CANADIAN NORTH-WEST TERRITORIES, 1870-97

(Publication No. 5565)

Lewis Herbert Thomas, Ph.D.
University of Minnesota, 1953

With the acquisition of the North-West, Canada faced the problem of governing dependent territory, with its concomitant issue of balancing central control and local autonomy. While accepting the principle of ultimate provincial status, the cautious and conservative Macdonald federal administration decided to provide a temporary territorial government of the simpler crown colony type pending an investigation of conditions and requirements of the North-West. The legislation embodying this decision encountered a hostile reception in the Red River Settlement where, inspired largely by the desire of the French métis to protect racial and religious privileges, a movement was organized which in 1870 resulted in the concession of provincial status to the Settlement and its immediate environs (Manitoba). For the rest of the North-West, a territorial government was established headed by the Lieutenant Governor of Manitoba. In 1873 a Council was appointed by the federal government with executive and legislative powers. Though its members were mostly Manitobans, the Council developed a vigorous sense of responsibility for the welfare of the Territories; with the encouragement of the able and distinguished Lieutenant Governor Alexander Morris (1872-77) it pressed for a larger measure of self-government, but without success.

In 1875 the Mackenzie administration sponsored legislation under which the North-West was given its own Governor and a new Council, and in 1876 the seat of government was removed from Winnipeg to a point in the Territories. Provision was made for the progressive introduction of elected councillors with the growth of population, but during Governor Laird's period (1876-82) only one member was elected and no vigorous autonomy movement developed, though the appearance of the press resulted in the ventilation of a number of local grievances and aspirations.

Under Edgar Dewdney (1883-88) the influence of the Governor reached its apogee, and this circumstance, coupled with the ofttimes inattentive and autocratic approach of the federal government, stimulated aspirations for increased autonomy among the elected councillors and the territorial population. The universal desire for representation in Parliament was conceded in 1886 (the Commons) and 1887 (the Senate), but the Council and later the Assembly continued the practice which had been followed since 1873 of making representations to the federal government on a wide variety of matters.

In 1888 Parliament replaced the Council with a Legislative Assembly, but all executive authority was vested in the Governor, with the exception of control of the expenditure of local funds, which was conferred on an Advisory Council selected from the Assembly. During Joseph Royal's governorship (1888-93) the Assembly (despite disagreements arising from conflicts of personality and national party loyalty) waged a persistent struggle under the leadership of F. W. G. Haultain to widen the executive powers of the Advisory Council and to gain control of the parliamentary appropriation from which most of the expenses of the territorial government were met. In 1891 the Abbott administration authorized local control of the parliamentary appropriation by a committee of the Assembly, which replaced the Advisory Council. Since the federal government still refused to sanction the establishment of an executive council, the Assembly during the years 1892-96 vested extensive executive authority in this committee, thus reducing the powers of the Governor, while at the same time it launched a campaign for a fixed subsidy similar to that given the provinces. Succeeding Conservative administrations at Ottawa took the stand that neither an executive council nor a subsidy were compatible with territorial status, but in 1897 the Liberal administration conceded the former demand with the result that the forms as well as the practices of responsible government were established within the framework of territorial powers.

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THE CAREER OF J. F. H. CLAIBORNE, STATES' RIGHTS UNIONIST

(Publication No. 5885)

Frederick DeForrest Williams, Ph.D.
Indiana University, 1953

This study of the career of J. F. H. Claiborne, an influential Mississippian who flourished in the period 1830-1884, represents an attempt to trace and evaluate his accomplishments in the fields in which he was active — politics, journalism, and history.

In endeavoring to present the subject in the proper historical light, general histories, monographs, biographies of his contemporaries, and periodicals were consulted, after which research in primary sources was undertaken. Of the latter, the most

important items examined were printed public documents, newspapers for which Claiborne served either as a correspondent or an editor, his historical productions, and the material in the Claiborne Papers and in the Claiborne Collection in the Department of History and Archives, Jackson, Mississippi.

By way of conclusions, the author maintains that Claiborne rendered a singular contribution to his state and country by helping expedite the removal of the Choctaw Indians to a location west of the Mississippi River. It is also demonstrated that throughout the ante-bellum period Claiborne exercised considerable influence in Louisiana and Mississippi, where he was widely regarded as a leading spokesman of the Democratic party. Claiborne the politician, like Claiborne the editor, was an ardent Jacksonian Democrat who opposed the American System of Henry Clay, and who fought for the preservation of states' rights and southern interests within the Union. It was his belief that the energies of the young republic should be devoted not to sectional strife but to constructive projects — territorial conquests, agricultural expansion and reform, the expansion of trade and commerce, and internal improvements carried out according to the letter of the constitution. The adoption of this positive policy, he felt, would turn attention away from domestic issues, bring about internal repose, and provide the time needed for the problem of slavery to resolve itself. In his opinion, the Democratic party was the only political organization capable of conducting a program that would save the Union.

In respect to Claiborne's work as an historian and as a collector of historical materials, his chief contribution was in bringing together and preserving a massive body of facts and documents. His historical works are colored by personal and political predilictions, and in his history of Mississippi he defended the right of secession, not the act of secession which he considered an error.

Microfilm copy of complete manuscript of 272 pages, $3.40. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1462.

JOSEPH ALBERT WHEELOCK: A STUDY OF HIS LIFE AND OF THE IMPACT OF HIS EDITORIAL DIRECTION IN ST. PAUL, MINNESOTA, AND THE NORTHWEST

(Publication No. 5570)

Quintus Charles Wilson, Ph.D.
University of Minnesota, 1953

Joseph Albert Wheelock, who served for almost half a century as a leading journalist in St. Paul, achieved during his lifetime a dominating place in the annals of journalism and community advancement as editor of the Pioneer Press and earlier territorial journals. His influence was not limited to his home city. Through the vigor of his editorial pen, his views gained wide acceptance in the Upper Mississippi region; indeed, on many of the significant and controversial issues of the day, his leadership was acknowledged throughout the nation.

Born in Nova Scotia in 1831, Wheelock came to Minnesota territory in 1850, and during his adult life he was continuously occupied with journalism and public affairs. His was a dominating force in the upbuilding of St. Paul and the Upper Mississippi empire. He brought the Pioneer Press to high rank as a journal exercising power in politics and in economic and social affairs. In point of long service as an editor, he ranked with many better known journalists of his day: Bryant, Pulitzer, Joseph Medill, William Rockhill Nelson, and Adolph Ochs.

His career encompassed the period of the frontier, the development of the Northwest, the liberal movement in politics, and the emergence of Minnesota from a sparsely-settled territory to a commanding position in the tier of Middle Western states.

After serving on the Financial Real Estate Advertiser and later the Pioneer and Democrat, Wheelock helped to establish the St. Paul Press in 1861 and later became its editor. When the Press purchased the Pioneer in 1875, he edited the consolidated newspaper until his death in 1875.

Characteristically a conservative on many public questions, nevertheless Wheelock was a liberal reformer within the framework of Republican Party principles. During the Civil War, Wheelock was a strong supporter of the Union and a staunch adherent of President Lincoln's principles. He supported Lincoln for re-election. In his earlier period he gave time to an unremitting campaign to bring settlers to the Northwest, and as the state developed he wrote constructively on the need for diversified farming, forest conservation, crop rotation, and similar matters.

Later, his views on sound money won him national attention. He is credited with great influence in the McKinley-Bryan campaign on the side of the Republican candidate. Later, he supported Theodore Roosevelt, sharing many of the President's views on conservatism and resisting the exploitation of public lands. Wheelock fought for a non-partisan civil service, opposed high tariffs, and advocated such reforms as resumption of specie payments.

He fought the Greenback, Populist, and Socialist movements; and was critical of the Farmers Alliance. He could never bring himself to approval of many of the tactics of organized labor, although in principle he did not question labor's right to organize.

Few men in his generation exerted such a constructive effort on behalf of civic development in St. Paul. Present-day residents of the city owe largely to Wheelock their excellent system of parks, play grounds, and public boulevards. He was a longtime member of the St.Paul park board. Wheelock Parkway stands as a monument to his work as a public-spirited citizen.

Wheelock believed in and practised constructive and responsible journalism. He vigorously opposed sensational journalism and a review of the pages of the Pioneer Press will reveal under his editorship a sober mind directing the policy of his journal.

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LANGUAGE AND LITERATURE, GENERAL

MILTON'S CREATIVE UNITARIANISM

(Publication No. 5889)

Ralph Kenneth Allen, Ph.D.
University of Washington, 1953

This study of Milton's religion identifies it as a self-consistent view of and attitude toward the mysterious universe and seeks to establish that it probably had the formative effect upon his own interior life which the historic Christian religion promised. Milton's religious point of view is basically a monistic spiritualism which, cosmologically speaking, may be called "pan-vitalism" — a sort of intuitionism apprehending the total universe as an organic unity, viable and developing, its chief raison d'etre being the actualization of diverse mundane personalities.

Central in Milton's outlook were such convictions as the following:

1. The importance of the self-creation of individuals as unique entities organic to the cosmos.
2. The importance for one's self-fulfillment of independent Scriptural interpretation and of knowledge of the primitive Christians, seen as exemplars, "with whom is bound up the life of learning."
3. The actual sovereignity of God, conceived positively as "living" and unitary though incomprehensible, not abstractly as an ens perfectissimum.
4. The actual and continuing creative "office" of Christ, whom Milton identifies with Son, Logos, and Word.
5. The mystic unity and subordinate nature of Christ.
6. The importance for the beneficent purposes of Christ, in the world, of self-realizing manhood, through the Reason of whom Christ chiefly works.
7. The importance of one's cultivating a mutuality of relation with Christ and with men in society, who live in mutual dependence, ideally as free consciences in quest of supreme values, Truth being among the chief.
8. The identification of "regeneration" with the self-creative way of life — a "gradual process."
9. The susceptibility to rational validation of all human intuitions and opinions. (The Logos did not operate by depositing Truth into human consciences.)
10. The sacramental importance of human expression. (Human reasoning is always tangential to ultimate Truth although the human mentality is veridical.)
11. The worship of God.

Milton looked ever toward cultural amelioration through the agency of spirituality among men. Mankind, he thought, was destined to a harmony reflecting the unity of God and completing the potential harmoniousness of the cosmos. A divine amateurishness is implied to be the ideal for men as thinking "saints." Conceptual water-tightness and intricate systematization, he thought, frustrates the operation of the Logos. Truth was not made up of ideas that are objectively correct or systematically proved. Milton was an advocate of Erasmian (i.e., primitive Christian) simplicity.

The principles of life upon which creative spirituality depended, he thought, were such as these: integrity; candidness and amplitude of expression; decorum; active espousel and solicitude; sanguinity through impregnable faith; rationality (reasonableness); charity as the enactment of rationality and its test; naive acceptance of the imponderables of the Christian religion; largeness of view, transcending all peculiarity; creative skepticism.

It is difficult successfully to apply to Milton our usual scholarly criteria for the identification of Puritanism. He must be envisaged, rather, as a Christian humanist who was, in his view, thoroughly Protestant and who was singularly thorough-going in the application of his religious principles. They precluded, for instance, a favorable view of burgeoning scientism, although his interest in science rightly pursued may never have abated.

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AMERICAN NOVELISTS IN ITALY: HAWTHORNE, HOWELLS, JAMES, AND CRAWFORD

(Publication No. 5573)

Harry F. Arader, Ph.D.
University of Pennsylvania, 1953

Supervisor: Sculley Bradley

Purpose

The purpose of this dissertation is to determine how their experiences of Italy affected the literary work of four major American novelists: Nathaniel Hawthorne, William Dean Howells, Henry James, and F. Marion Crawford.

Methodology

In order to discover how the various aspects of their Italian experiences affected the literary work of these novelists, it was necessary, of course, to examine the experiences as well as the works. The correspondence, journals, diaries, and notebooks, the poems, travel sketches, art and literary reviews, critical studies, dramas, short stories and novels — provided information on what the authors had done, seen, and thought while in Italy. Their experiences of the nature, art, history, literature, religion, politics, and social life of the country — and the thoughts and opinions these experiences gave rise to — were isolated and taken into account. The creative works — with particular attention devoted to the novels — revealed how the various aspects of the Italian experiences and the various attitudes growing out of them affected the development of background, character, and theme.

Each novelist's selection of materials was regarded as significant — whether it was an essentially romantic selection limited only to materials useful in conveying an idea or moral, or an essentially realistic one embracing all that might serve in presenting a complete and faithful picture of Italian life.

Findings

Examination of the Italian experiences and the Italian influenced work of the four novelists revealed the full extent to which the foreign country provided them materials for artistic creation.

In their reactions to the romantic aspects of the country — and to the romantic American expatriates who, they felt, languished there — Hawthorne and James found motivation and theme for major works; in the expatriates they found material for character development. The Italian picturesque, Italian art, and the sense of the pagan past, moreover, served these two authors effectively in the development of their theme. James and Howells sensed a contrast between the genuine morality of naive American travelers and the sophisticated manners of Europeans and Europeanized Americans, and gave this contrast some fictional development. In Italian literature Howells discovered the values of realism, and he succeeded in incorporating into his own literary work the real qualities of Venetian life — just as he felt the Venetian dramatist, Goldoni, had done earlier. Howells and Crawford used their extensive knowledge of the contemporary Italian scene to provide convincing settings and realistic background detail. Howells wrote a number of critical studies based on Italian literature; Howells and James made extensive use of the Italian scene in travel sketches; and Howells and Crawford drew historical volumes from their knowledge of the Italian past.

Analyses of the various methods of selecting materials revealed the essentially romantic technique of Hawthorne and Crawford, and the essentially realistic technique of Howells and James.

Contrasts between the romantic and the realistic attitudes toward Italy were seen as of primary importance in Hawthorne's and James' development of major themes.

In each case, an understanding of the relationships between the nature of the Italian experiences and the nature of the Italian works made possible a more complete understanding of the works. As light was thrown upon the novelists' methods of utilizing their Italian experiences in their literary creation, understanding of the full significance of the Italian work was advanced. Seen from the vantage point of their relation to a specific experience, the Italian influenced work of Hawthorne, Howells, James, and Crawford was more soundly known, more completely realized.

Microfilm copy of complete manuscript of 512 pages, $6.40. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1465.

ORGANIC UNITY: THE PRINCIPLE AND ITS APPLICATION IN THE CRITICISM OF COLERIDGE

(Publication No. 5642)

Maynard James Brennan, O.S.B., Ph.D.
University of Michigan, 1953

The purpose of this study is to find out what Coleridge meant by the principle of organic unity, and then to see whether he applied it in his practical criticism.

The first chapter is concerned specifically with the definition of organic unity as it can be learned not from his literary criticism alone, but from his speculative and philosophical writings as well. The definition is treated under three aspects: the biological, which centers on the high state of individuation within the artist; the epistemological, which centers on the theory of mind and imagination; the metaphysical, which centers on the theory of matter and form in Coleridge, and its relationship to scholastic hylomorphism. All three aspects are interconnected and interdependent, and when they are fitted together, as best they can be, something approaching definitiveness is realized.

The second and third chapters are concerned with the pragmatic test of the doctrine of organic unity: the former looks directly at the Biographia Literaria, particularly the Wordsworth criticism; the latter concerns itself with the Shakespeare criticism. These chapters, which do not seek to evaluate, show that Coleridge did apply the principle of organic unity.

The main conclusions to my theory are: (1) the principle of organic unity is probably the central and most important part of Coleridge's aesthetics and literary criticism; (2) the doctrine is at least implicitly applied in the Wordsworth and Shakespeare criticism; (3) in fact, his whole practical criticism is robbed of its ultimate significance unless we see the organic-art principle operating at

all times, directly or indirectly; (4) the most valuable part of the definition, in theory as well as practice, is the metaphysical. The standard tests for measuring the organic nature of any poem or play are: unity of interest and faithfully maintained illusion; a center of focus, which in drama is characterization; a primary end of immediate pleasure to which all other ends are duly subordinated; and a perfect coalescing of thought and feeling, matter and manner, in the untranslatable, indestructible objective correlative.

Microfilm copy of complete manuscript of 254 pages, $3.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1466.

SATIRE IN ENGLISH DRAMA, 1590-1603

(Publication No. 5784)

Oscar Gross Brockett, Ph.D.
Stanford University, 1953

This study was undertaken to present a survey of dramatic satire from 1590 to 1603, to consider values and literary methods in this period, and to examine the relationship between dramatic and formal satire. In the absence of a generally accepted definition of satire, a working definition, evolved from a survey of the history of this term, designated satire as that element in literature which aims at arousing ridicule or indignation for the purpose of reprehending vice or folly. It may be either serious or comic.

The ninety extant plays of this period (excluding those of Shakespeare) were used as a basis for the conclusions reached. Satire appears in seven-eighths of these plays. It is classified, in terms of subject matter, in the following categories: social, moral, literary, political, classes and professions, religious, nationalities, and personal. Examples of social and moral satire occur twice as frequently as those of all other types combined.

Social satire was subdivided into the satire of social abuses, manners, and miscellaneous social satire. That of social abuses comprises only one-eighth of the total, while manners accounts for one-third, leaving over one-half of the social satire in the miscellaneous category (concerning such matters as the shift in social classes, etc.).

Moral satire may be classified in terms of the Seven Deadly Sins. Lust, avarice, and pride are the major motivations in this drama; these three account for most of the examples of moral satire.

Literary satire deals with almost all aspects of literature. Much of it involves the War of the Theatres, with which the examples of personal satire are also associated.

Political satire is somewhat ambiguous, because the concept of tragedy as "the rise and fall of tyrants" may account for much of the criticism of political practices. Practically no examples of it can be related to specific events of the time.

Of the large number of professions satirized, only five are treated extensively: members of religious orders, lawyers, merchants, soldiers, and poets. Classes satirized are principally the courtiers and the commons.

Religious satire is restricted to particular sects or practices of a controversial nature. Practices on which general agreement existed are classified as subjects of moral satire. No satire of fundamental theological questions appears.

Nationalities satirized are principally four: Spanish, Dutch, French, and Italian, each of which has its own peculiar characteristics. Dialect is a secondary source of ridicule.

Satire of religion, politics, and social abuses constitutes the satire of controversial subject matter. It is significant that all of it comprises only one-eighth of the total satire.

Techniques used in this satire include irony, burlesque, parody, wit, and invective, the first three of which are represented by very few examples. Comic satire makes up less than one-third of the total; the typical satire is serious in its tone, employing direct denunciation or invective.

There is a distinct cleavage in tone around 1597, when the interest in classical genres and the critical spirit enter the drama. This change occurs simultaneously with the exploitation of formal satire. Literary and personal satire, and that of manners, are restricted almost entirely to this part, and occur in increasingly large amounts. The norm presented by the satirists shifts gradually from that of Christian virtue to the "golden mean," thus allowing a less moral tone and an increased use of humor. While these new tendencies increase markedly after 1597, the majority of the plays retain a primarily moral tone and continue to uphold the norm of Christian virtue.

Microfilm copy of complete manuscript of 314 pages, $3.93. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1467.

SO DEEP A TRAIL: A BIOGRAPHY OF CLARENCE KING

(Publication No. 5791)

Harry Herbert Crosby, Ph.D.
Stanford University, 1953

The life of Clarence King, (1842-1901), a geologist, adventurer, man of letters, and shaper of American foreign policy, epitomizes what happened to American intellectuals at the end of the Nineteenth Century.

Born in Newport, R. I., King was left fatherless after a shipwreck and brought up by his intellectual, devout mother. In 1862, he graduated from Yale's Sheffield Scientific Academy, and in 1863, travelled to California with James T. Gardner. They soon secured employment with the California Geological Survey. Between 1863 and 1866 King increased his

knowledge of geology and indulged his enthusiasm for mountain climbing and other adventures. He was the first to climb several California peaks.

In 1866 he conceived a plan to get Congressional support for a geological survey of the territory surrounding the new trans-continental railroad from Greeley, Colorado, to California, and at twenty-five, he became a director of the "Geological Survey of the Fortieth Parallel." He spent 1867-79 directing the study of geology, botany, zoology, and paleonthology in his area, presenting at the end a seven-volume report which the Brookings Institute suggested as a model for later government reports. Meanwhile, he became a close friend of Henry Adams, John Hay, Bret Harte, and William Dean Howells. In 1871 he wrote Mountaineering in the Sierra Nevada, which, along with Harte's "Plain Language of Truthful James" and Hay's Pike County Ballads, first interested readers in western locale and the laconic, dialect-speaking regional characters important in the "Rise of Realism."

King increased his national reputation in 1872 by exposing a huge diamond swindle which had duped financiers, jewelers, and mining experts.

By 1879, four other geological surveys were sponsored by the government, and rivalry among them became so intense that reformers and scientists demanded a consolidation. After a bitter political fight, the surveys were consolidated and King became the first director of the United States Geological Survey.

Two years later he resigned, ostensibly to devote himself completely to science but actually to earn a quick fortune, necessary now to support his newly developed extravagances. Within a year, in partnership with Henry L. Higginson and Alexander Agassiz, he made over a million dollars, but squandered it immediately in an all-conquering tour of Europe. Part of his journey he recorded later in a sketch entitled, "The Helmet of Mambrino," published in Century magazine.

His fortune depleted, King returned to America in 1884 and tried to regain his old devotion to science. Instead, his inclination to indulge any whim that came along became more and more evident. He spent his time pleasantly but fruitlessly with the elite of Washington and New York society, a dilettante in art, literature, and conversation. The only products of 1884-93 were a few book-reviews, a rather perfunctory article insisting that the world was was no older than twenty-five million years (which brought him short-term scientific fame), and two articles recommending a union of classical and scientific education.

In 1895, he organized a cabel of himself, Henry Adams, and Senator Don Cameron who, associated with Senator Henry Cabot Lodge, worked to convert Congress to support the Cuban cause. After 1896, he dropped out of national affairs, active only in a frantic pursuit of health and fortune. Just past the end of the century, he died, alone in an Arizona tavern, his life a puzzling failure — a symbol of a wasted generation.

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ATTITUDES TOWARD THE NEGRO IN SOUTHERN SOCIAL STUDIES AND NOVELS: 1932-1952

(Publication No. 5508)

Robert Bennett Gilbert, Ph.D.
Vanderbilt University, 1953

During the period from 1932 to 1952 revolutionary agricultural practices, rapid industrialization, and World War II greatly changed Southern society. Amid these changes how has the Negro — a determining factor in that society — fared? What have notable white Southern fictionists and nonfictionists written about him?

In their works the nonfictionists present three attitudes: that the Negro is a noble primitive; that he is an inferior but loveable creature; and that he is a human being, entitled to the rights of a human being. The liberals, holding this last view, differ in their interpretation of these rights, in their attitude toward the South, in their estimation of the Negro's progress or lack of progress, in the tone of their materials, and in their solution of the race problem. In sum, their books indicate, one, a renaissance in Southern social writing paralleling that in literature, and, two, a progression from the opinion of limited social participation for the Negro to that of unlimited egalitarian participation.

The novelists using the Negro as fictional material have produced works of minor or major significance. Those of secondary importance continue, with variations, the older literary traditions of the Negro and, in addition, characterize him as a human being. The tradition of the comic Negro, the plantation darky, the tragic mulatto, and the primitive exotic appear less often than the Negro as a social problem. The social novels, reflecting ideas and purposes similar to those of the social scientists, contain no Negro characters who "touch the imagination or the heart" and, as a result, are literary failures.

Novelists who approach the Negro as a human being portray the Negro more successfully than do those in the other groups. They show him as a figure possessing charm, dignity, and nobility; an attitude of compassion and a desire to make him live as a character always dominate their treatment. Of these writers Ellen Glasgow, Brainard Cheney, and Carson McCullers have drawn outstanding Negro persons.

T. S. Stribling, Erskine Caldwell, and William Faulkner use the Negro as major material. Stribling and Caldwell present him as a social problem; despite wooden representations and clumsy plotting, their works are popular. Although sometimes Caldwell's short stories are powerful, he, like Stribling, has contributed no memorable Negro character.

Of all Southern novelists Faulkner has written most significantly about the Negro. In the Yoknapatawpha County series the Negro plays a vital part: he is the symbol of the curse of slavery and the repository of virtues the white man no longer possesses. From the conception of the Negro as a comic darky, Faulkner has advanced to the belief that the Negro is

the white man's savior. To the list of unforgettable characters in American fiction he has added the Negro in "Red Leaves", Dilsey, Nancy, Joe Christmas, Sam Fathers, and Lucas Beauchamp.

The fictionists and nonfictionists together show a deep concern for the Negro and present him with sympathy. Concerning his problem, the social scientists and the social novelists often have their solutions; these range from the opinion of dispersing the South's Negro population over the nation to that of ending discriminations immediately. The better novelists pose no answer; they see the Negro's lot as doubly hard in a world where all men are caught or broken. Faulkner, however, declares that the problem is the South's, and the South alone can solve it. Finally, all these writers show that if the presence of the Negro has led nonfictionists to examine the South critically, it has also led Faulkner to create some of the greatest characters in American literature. Twenty years or one generation should ask for no more.

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THE HUMOR OF THOREAU

(Publication No. 5472)

Harold N. Guthrie, Ph.D.
State University of Iowa, 1953

The lack of agreement concerning the nature of Henry David Thoreau's excellence as a writer warrants a careful consideration of his humor, one facet of his genius which has been too often misconceived, depreciated, neglected, or even denied. This dissertation contends that a proper adjustment of our critical view of Thoreau's humor is not only important in itself but that it is also essential to a just and complete view of the man and his works.

Representative critical estimates of Thoreau, from his lifetime to the present, illustrate the complexity of the critical view of Thoreau and the neglect, even denial, of his humor.

That Thoreau had an unusual sense of humor is amply demonstrated by the biographical testimony of his friends, William Ellery Channing, Edward Waldo Emerson, and Franklin B. Sanborn and by the internal evidence in his own writings, especially the Journal. In his essay on Thomas Carlyle, Thoreau presents a convincing theory of humor which applies as appropriately to his own writings as to those of Carlyle. Moreover, it is agreeable to the theory of humor advanced in this dissertation, which holds that humor is a recognizable, if indefinable, variety of pleasure ranging from smiles to hearty laughter and closely related to play, not identified with other emotions, either amiable or contemptuous, but usually more or less combined with them. Thoreau remarks that humor provides a leaven for otherwise indigestible philosophy and that it is a pledge of sanity which exempts the writer from charges of fanaticism, mysticism, and lunacy.

In his writings, Thoreau's humor generally appears in the form of exaggeration, paradox, sententious statement, word-play, whimsical metaphor, and irony, or varying combinations of these forms. None of his works is totally lacking in humor, but the humor varies in kind and amount depending upon the particular purpose of each work. Walden is one of the most, and The Maine Woods one of the least, humorous of his writings. His humor ranges in kind from the bitterly satirical attacks which characterize his "Plea for Captain John Brown" through the whimsically genial descriptions of nature in A Week on the Concord and Merrimack Rivers and Walden to the trivial jests, harmless puns and word-play, which appear frequently in Cape Cod and A Yankee in Canada.

The major function of Thoreau's humor is satire. He deliberately employs humor as a weapon in his attacks on men and institutions, social, religious, and political institutions which he feels are either idle and time-wasting or positively harmful to the individual. Thoreau proposes no utopian schemes to supersede the systems he satirizes, nor does he envisage a uniform patterned adjustment of all men to nature and society. He welcomes diversity, but he insists upon the Transcendental principle that every man must trust his own instincts, not tamely conform to conventional patterns.

A careful consideration of the significance of Thoreau's humor shows him to be not so much a prose-poet, scientific naturalist, or systematic philosopher as a laughing satirist who preaches "other things than usual." His humor is a not inconsiderable portion of the wealth he has bequeathed to his readers. And for those who understand it, Thoreau's satirical attacks on men and institutions arouse, not resentment and counterattack, but laughter and a return to our senses.

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JAMES KIRKE PAULDING: A PIONEER IN AMERICAN FICTION

(Publication No. 5597)

Harold E. Hall, Ph.D.
University of Pennsylvania, 1953

Supervisor: Robert E. Spiller

James Kirke Paulding, one of the most prolific and popular American writers of his time, deserves the distinction of "pioneer." He lived two lives — in literature and politics — and achieved a remarkable, if temporary, success in both. As a writer, he produced works in every literary form known to his age and is perhaps more representative than any other individual of the innovation and diversity which

characterize the Knickerbocker era of American literature.

Although he typifies his time and place, Paulding was not a product of his generation. Born during the Revolution, he had his roots in the eighteenth century, and he was antagonistic to the end of his life to the Romantic Movement. So often identified as Washington Irving's friend and early literary collaborator, Paulding represents a fundamentally opposed aspect of American culture. Irving became absorbed in European romanticism and was influenced largely by Scott. Paulding clung to the traditions of Fielding and Goldsmith and sought originality by turning his eyes to his native land, particularly the western frontier, for his subject matter.

Paulding's eighteenth-century temperament is evident in his fiction, both in theory and practice. Though his critical statements are scattered throughout his works, Paulding's theory of his craft was perhaps more fully developed than that of any other writer of his time except Poe. A strict rationalist, he insisted always upon reason as opposed to emotion, and his one major attempt towards a synthesis of his critical position he designated by the term, "Rational Fictions."

There was a political undertone to Paulding's hostility to romanticism. He considered it primarily an English movement, an example of British decadence. He saw in America a haven for political freedom and democracy, and he expressed the attitude that literature thrives only in free countries. Consequently, he was one of the leaders of the determined movement to break all cultural ties between the new and old worlds.

Positively, he called for literature that would reflect American life, particularly the unsophisticated aspects. He wanted simplicity in language, realistic situations developed rationally according to the laws of cause and effect, characters as they were in real life, and he asked his younger contemporaries to focus their attention upon the contemporary scene.

The short story, as a distinct literary form, was unknown in Paulding's time. The only difference recognized between the tale and the novel was the length, and even this was indefinite. Paulding's own short fiction varies from fables of two or three paragraphs to novelettes. But the short story may be regarded as an American invention, and Paulding deserves credit with Irving for turning the character sketch into short story. Though Paulding too often regarded the tale as having subliterary importance, he occasionally showed traces of the conscious literary artist. But his general "hasty and negligent composition" often resulted in a simple, direct narrative such as more conscientious stylists of the time were unable to achieve. The spontaneousness of his stories also provided an antidote to the artificiality of much of the literature of his time.

Paulding's poorest stories are those in which he is obviously making concessions to the literary tastes of his time. This defect is almost the most serious of his faults as a novelist. The most representative of his novels is Koningsmarke, a burlesque of the Waverly and Gothic novels in addition to being a political and economic satire of his own time. Borrowing form and tone from Fielding, Koningsmarke demonstrates Paulding's kinship to the picaresque tradition. But Paulding then succumbed to the demands of romantic readers. Each of the four novels which followed Koningsmarke gives evidence of the compromise. He incorporated those aspects of romanticism which he considered least objectionable, and he tried to suppress the satirist. His contemporaries read his novels as romances, and later critics have tended to regard Paulding as a romancer only slightly inferior to Cooper and Simms.

Within the past decade there has been growing a moderate critical revival of Paulding. His faults have been apparent from his own time, and these will probably keep him always out of the front ranks of American writers. But the revival should make clear that Paulding's literary battle with British travelers and reviewers was only half of his private war. At home he was one of the few classicists who never accepted romanticism.

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ROGER ASCHAM AND HUMANIST EDUCATION IN SIXTEENTH CENTURY ENGLAND

(Publication No. 5600)

C. Fenno Hoffman, Jr., Ph.D.
University of Pennsylvania, 1953

Supervisor: Allan G. Chester

Humanist education, the subject of this dissertation, was fostered in England by Erasmus and developed during the sixteenth century by teachers and writers such as Vives, Colet, Lyly, Mulcaster, Lawrence Humfrey, and Sir Humphrey Gilbert. Roger Ascham is seen as a central figure in developing the humanist tradition, especially as it was applied to secondary school education. Other sixteenth and seventeenth-century educators considered, besides Ascham and the others named above, include Cleland, Brinsley, Peacham, Hoole and Milton, in England, and continental writers including Castiglione, Rabelais, Montaigne, and Comenius.

From his arrival at St. John's college, Cambridge, in 1530, until his death in 1568 Ascham was preoccupied with the study of Latin and Greek literature. Forming his tastes at St. John's largely under the influence of John Cheke, he developed a passion for scholarship which expressed itself in study, in teaching, and in writing about his work.

Ascham's own interests coincided with the exclusively literary subject matter of humanist education, as Erasmus, Colet, and Lyly had formulated it. As a teacher, Ascham insisted on the need for translation to supplement the study of grammatical rules. The brutality practised in many schools led Ascham

to defend translation on grounds of humaneness as well as sound scholarship. As Queen Elizabeth's tutor, Ascham was in a position to advocate the same course of study for women as for men.

Primarily a private tutor, Ascham encouraged scholarship among the gentry in order to make them worthy of their responsibilities. He had the advantage of being a lover of outdoor sports, particularly archery, and he saw that the tradition of arms rather than studies among the gentry was one that must be modified and not altered overnight. He defended archery as valuable exercise in itself, as relaxation from study, and as a great English tradition.

As a humanist, Ascham might have shared in the humanist contribution to science, that is in supplying fresh translations of Greek scientific works, as Linacre had translated Galen. However, he distrusted science, believing apparently that it tended to deform the characters of those who devoted themselves to it. Humanist education, as Ascham saw it, was uniquely able to build good moral character.

Sound morality (based on Greek and Christian doctrines) and a proper literary style were Ascham's goals as an educator, and the goals of most humanists. Extreme humanists had concentrated on style alone, giving rise to a controversy over "imitation". Following Erasmus, Ascham used imitation (a refinement of translation) as a teaching device because he believed that the greatest classical writers had not been equalled and that a close study of the best stylists would produce the desired results for the scholar in literary style and in good character. The inherent conservatism of humanist educational thought must be seen in the light of Renaissance achievements in literature, but it led inevitably to attack and, in some instances, to reform. The humanist stamp, nevertheless, remained unmistakably on English secondary education, at least until the last half of the nineteenth century.

Chapter headings in this dissertation are as follows: I, Humanism and Education, an Introduction; II, The Grammer School; III, The Education of Women; IV, The Education of the Gentry; V, Sport: The Book and the Bow; VI, Science in Education; VII, Protestantism and Philosophy; VIII, The Goal of Literary Style.

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KING PONTHUS AND THE FAIR SIDONE: A CRITICAL EDITION

(Publication No. 5605)

Edith Smith Krappe, Ph.D.
University of Pennsylvania, 1953

Supervisor: MacEdward Leach

The purpose of this study is to provide a critical edition of the 15th century M.E. romance King Ponthus and the Fair Sidone and to include the text of the first printed edition, issued by Wynkyn de Worde in 1511. My edition is based on versions of the Ponthus story extant in England only: (1) In English: MS. Digby; MS. Douce 384 (a fragment of two leaves closely corresponding to Digby); the de Worde quarto; and a fragment of four leaves (STCat. 20107) corresponding closely to the 1511 edition. All the English versions are in the Bodleian. (2) In French: MS. Royal 15. E. VI (B.M.); MSS. Hh 3. 16 and Ff 3. 31 (Cambridge University). The Digby MS. was published, with notes, by F. J. Mathers, Jr., in PMLA, XII (1897).

My edition of the Ponthus presents the text of Digby with as few emendations as possible and those only after careful consideration of the readings in the three French MSS. A critical introduction of lxxix pages precedes the two texts. Notes on forms, content, and background; collations; a general comparison of incidents from all the Horn versions; and glossaries of proper names and uncommon words follow the texts (pp. 1-459) in separate sections (pp. 460-797). A selected bibliography covers pp. 798-811. The Digby and the de Worde texts are on alternate pages for the purpose of comparison.

The Ponthus is a variant of the widespread King Horn story. Although associated by A. de Montaiglon with the de La Tour family for which he thought it written, the romance cannot have been connected with the historical Ponthus, grandson of Geoffrey de La Tour Landry, since the boy, whose death occurred c. 1425, would have been too young to inspire a story. The 15th century de La Tour family is thus merely mentioned therein as are other Breton and Poitou families.

Although Mather considered the Royal MS. to be the source of Digby, my collation of over two thousand passages indicates (1) that none of the three French versions is the immediate source of Digby; (2) that all four stem from some common Ur-text after passing through an undetermined number of intermediaries; and (3) that MSS. Royal and Hh are more closely related to each other than to MS. Ff.

The printed edition (W) represents a longer, fuller version, set up possibly from an older Digby in conjunction with some French version, thought by Mather to be the Ortuin edition (Lyon, c. 1500). Yet striking differences between Ortuin and W in both text and rubrics make Mather's assumption very doubtful.

I list and describe 26 continental MSS and nine early French editions. The later progress of the story in France is evident from the fact that Ponthus

is introduced as an accepted historical character in Bourdigné's Chroniques (printed 1529) and twice cited in the Bibliothèque des Romans (1734). A long abstract containing details lacking in Digby, Royal and the Cambridge MSS. is furthermore contained in the Mélanges Tirés d'une Grande Bibliothèque (1780, x). The story was first translated into German between 1448 and 1456 by Eleonore, wife of Sigismund, duke of Austria, and was constantly reprinted and referred to by writers and booksellers. In the 16th century Ponthus' adventures were recounted in a series of Icelandic rímur. Certain verses still live on in popular Icelandic tradition.

A detailed comparison of incidents from the Horn versions is included in my Notes and shows that, in spite of the different names employed for the characters, Ponthus contains typical features of the Horn story.

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THE DEIRDRE LEGEND IN ENGLISH LITERATURE

(Publication No. 5827)

Marcia Schuyler Kelley Miller, Ph.D.
University of Pennsylvania, 1950

Supervisor: MacEdward Leach

This dissertation, The Deirdre Legend in English Literature, is a study of the various treatments of the ancient Celtic legend in English and Anglo-Irish literature. Through descriptions and criticism of these treatments, it attempts to show how each writer in turn used the legend: how creatively he handled it; how faithful he remained to the spirit of the original story; how he adapted it to his own tastes or to the tastes of his time; how well he suited the story to the medium — poem, prose tale, play, novel, opera — he selected. The various treatments are discussed in chronological order, to show how, in general, the interpretations follow the different thought, mores, and literary standards of the periods in which they were done. After a chapter on the Deirdre legend in Gaelic literature, the English treatments of the eighteenth and nineteenth centuries are discussed, beginning with the first known allusion to the story in English, in the play The Welsh Embassador, 1623. A chapter is devoted to the treatments of the Celtic renaissance; another to the two greatest treatments of the legend — the plays by Yeats and Synge; and a concluding chapter to the treatments from the Celtic renaissance to the present, the latest being a novel And then You Came by Ann Bridge, published in 1949.

Finally, this study attempts to show that the Deirdre legend has been so long-lived and so popular because it has two great and universal themes, an ideal love and a woman's fatal beauty. The has attracted so many writers because it is, in its original forms, simply and objectively told. It contains very little interpretation and explanation and therefore many writers have been drawn to retell it in the light of their own thought and experience.

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IRISH CHRISTIANITY AND BEOWULF: BASIS FOR A NEW INTERPRETATION OF THE CHRISTIAN ELEMENTS

(Publication No. 5515)

Margaret Williams Pepperdene, Ph.D.
Vanderbilt University, 1953

The presence of a strong Christian element within the essentially pagan poem Beowulf has occasioned a long and schismatic controversy among the scholars of this poem with regard to its original composition and content. With the inquiries of Müllenhoff and Ettmüller a school of "dissectionist" scholarship developed which proposed that the poem was originally composed of single songs or lays, later brought together into a single poem, and that in this process of assimilation the Christian passages were interpolated by a later Christian scribe. The interpolation theory received strength from the cogent arguments of Chadwick and Blackburn, who based their contentions chiefly on the lack of reference in the Christian passages to specific Christian dogma with detailed passages of pagan customs. On the other hand, scholars like Klaeber and Chambers, and Tolkien outside the controversy, have attempted to prove the integrity of the poem as a whole artistic piece, inclusive of the Christian passages which they considered essential to the whole. This school of critics has not, however, given convincing evidence that the Christian elements have any natural associations with the paganism of the poem; and the isolated condition of these elements, first effected by the "dissectionist" school, has never seriously been disturbed. The point of strain for the entire structure of the controversy is whether or not it is possible to effect a reconciliation between the presence of the Christian elements and the strong pagan manifestations within the poem.

Every contributing scholar to the controversy, whether supporting the interpolation or integration of the Christian elements, has tacitly or explicitly assumed that these elements were representative of the orthodox, Western European, or Roman, Christianity of the seventh and eighth centuries, the period to which the composition of Beowulf in its present form has been assigned. Actually, there was another Christian influence upon the Anglo-Saxons which was more congruous with pagan custom and belief than Roman Christianity, and it is the purpose of this study to show that with the substitution of Irish Christianity for Roman as the

source from whence came the Christian sentiments in Beowulf the irreconcilable co-existence of pagan and Christian elements will no longer present a problem.

The plausibility of using Irish Christianity is established through the factual presentation of the conversion to Christianity of the Anglo-Saxons, through the description of the development of the Irish church as a separate organization, isolated and distinct from the continental Christian churches, and through the examination of the distinct features of the organization and liturgy of the Irish form of Christianity in the seventh century. Further, the peculiar characteristics of Irish Christianity have been defined: its eclectic quality, its lack of rigidity of form, its subordination of form to spiritual asceticism, its containment of pagan and barbaric beliefs and customs within the Christian framework, and its views of the pre-Christian heroic age of paganism as a noble and fitting preamble to the coming of Christianity.

Irish Christianity demands close attention as the Christianizing influence upon Beowulf, because there is nothing in Irish Christianity, or in its own aspect toward paganism, which is alien to the subject matter and treatment within the poem. In the practices and literature of Irish Christianity may be seen not only a reconciliation of pagan and Christian elements, but a fusion. The nature of Irish Christianity answers the questions put by the scholars concerning the problems of the Christian elements. Within the framework of a culture influenced and converted by Irish Christianity such a poem as Beowulf could have been written as a whole, artistic piece, with both the pagan and the Christian elements making equal contribution to the meaningfulness of the epic.

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A ROVING MIND: A REVIEW AND APPRAISAL OF GEORGE MOORE'S PRONOUNCEMENTS ON LITERATURE, PAINTING, AND MUSIC

(Publication No. 5833)

Winifred Irene Nelson Potter, Ph.D.
Bryn Mawr College, 1950

This thesis deals with George Moore's criticism. It contains a brief account of the four periods in Moore's life: (1) France in the 70's - the contact with Impressionist Art and French Literature; (2) England in the 80's and 90's - the dramatic and art critic; (3) Ireland at the turn of the century - the contact with the Irish Literary Movement; (4) the final period in London.

Throughout, stress is laid upon the unorthodox nature of Moore's criticism. Moore believed in instinct as opposed to reason. He judged a work by the instinctive appeal it made to him, and condemned what failed to gain his approval.

French poetry only temporarily attracted him; instead he emphasized the novelists, especially Balzac.

In painting his criticism was personal, literary, impressionistic - never a reasoned study. Of importance is his championship of the Impressionists when their work was unknown in England.

As a critic of Victorian painting he deprecated the insistence upon accurate representation of objects rather than upon originality, individual response and sensibility. He criticized the anecdotal, moralizing, and sentimental traits pandering to Victorian Respectability and Commercialism. Rather than cumbersome, gilt-edged works he advocated smaller paintings suitable for the middle class, Degas' ballet girls, Manet's work, and Whistler's nocturnes.

As a Victorian dramatic critic Moore concurred with Shaw and Henry James in deprecating the literary ineptitude of the London stage, the sensationalism, and cliches in speech, characterization, and incident. He advocated new plays incorporating provocative thought, and championed Ibsen, at that time an anthema.

In music Moore was a "literary musician." His comments here are interesting, but negligible, confined mainly to Wagner.

In the Irish period Moore's characteristic trait, the inability to be dispassionate, is shown in portraits of Irish literary leaders, vividly and often maliciously delineated.

It is on the novel that Moore's comments are especially valuable. Few English novelists approached in any way his definition of the "true artist" - "one who captures the world with broad human sympathy and woos and wins his fellows with his craft." English fiction was confined to the notation of manners and customs, with little inward penetration; technically it was inept. Hence Moore dismissed most of the well-known novelists; only Dickens, George Eliot, Anne Bronte, and Jane Austen partially approached his "true artist."

Moore's criticism of modern authors was affected by his view of the Modern Era as a blighted, materialistic, mechanized age. Only Pater reached heretofore unattained heights. Modern novelists he dismissed with a quip: D. H. Lawrence was " a man of talent, but unbalanced."

Moore's criticism of Russian literature is mainly confined to Tolstoy and Turgenev; the former he disliked in proportion as that novelist became more didactic; but Turgenev was Balzac's equal in tale-telling.

In the realm of poetry Moore is at his most whimsical with theories of pure poetry and the symbolism of a poet's name. As always, his comments are spiced with personal reactions and wit.

Despite the faults, it is a keen mind that views literature and painting. Grant Moore his idiosyncracies, and one has a critic who interprets with a vitality and independence more refreshing than the

safe judgments of more stable men. A keen perception of what a work was, coupled with the precariousness of a nature that sometimes upset the balance of that perception are the prime characteristics of Moore's criticism. Not a great critic, then, but a refreshing one, penetrating rather than profound, never dull, always stimulating, and using the comic spirit to attain his ends.

Microfilm copy of complete manuscript of 219 pages, $2.74. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1476.

THE WHORE OF BABYLON BY THOMAS DEKKER: A CRITICAL EDITION

(Publication No. 5615)

Marianne Gateson Riely, Ph.D.
University of Pennsylvania, 1953

Supervisor: Matthew W. Black

This edition of The Whore of Babylon is a modernized text based on an examination of eighteen (all but two) of the extant copies of the unique quarto of 1607. Notes supply the original readings of the quarto in the case of archaic forms, doubtful passages, and emendations; explain allusions; cite sources; and indicate parallels with Dekker's other works.

The Introduction endeavors to show that the play has decided unity of theme and a carefully planned structure, and that as a whole it reflects a wide range of historical reading and a responsible attitude toward the historical play on the part of Dekker.

Allusions in Lectori, an address which Dekker prefixed to the quarto, and the correspondences with Dekker's tract The Double PP point to the Gunpowder Plot as the immediate inspiration and a composition date in late 1606 or early 1607. Conjectures by Fleay (Biographical Chronicle) and M. L. Hunt (Thomas Dekker, 1911) that the present play is based on an earlier version, c. 1600, are rejected: the "revisions" cited are explicable without assuming re-writing, and notably a supposedly corrupt passage on G4 is seen as logical if it is understood that the traitorous nobleman alluded to is the fourth Duke of Norfolk, not Essex. There are clear indications of the play's contemporaneousness with Dekker's work in 1604-1609, as well as suggestions that Dekker was courting James' favor.

Dekker was indebted to Spenser for little more than names and the conception of Elizabeth as the Fairie Queen. It cannot be stated categorically that he derived his allegory from Spenser, for the identification of the Roman Church with the whore of Babylon of Revelation was a common-place under Elizabeth and James; and while his Falsehood is doubtless Spenser's Duessa, the idea of personifying Truth came from a coronation pageant presented before Elizabeth and owes virtually nothing to Spenser's Una.

In The Whore of Babylon Dekker was a meticulous historian according to the lights of his day; though he claimed a dramatist's right to take liberties with chronology, in other respects he adhered faithfully to contemporary chronicles and tracts. Holinshed contains sufficient material to have furnished Dekker with his opening dumb show of Time and Truth, his allusions to the papal bull of 1570, the plots of Parry and Campion, his remarks on the Irish, and his allusions to the Northern Rebellion and the Babington conspiracy; in addition Dekker may have made use of references to Lopez, the Prince of Portugal, and the States of Holland. He drew from Stow's Annales the figures for the English land forces assembled to meet the Armada, and from A true discourse of the army which the King of Spain assembled (1588) a detailed inventory of the Spanish sea forces. His main source for the Lopez plot was possibly A true report of sundry horrible conspiracies, 1594.

The accounts of the English armies in 1588 and the Parry plot make certain the identification of some of the dramatis personae: Fideli (Lord Charles Howard), Florimell (Leicester), Elfiron (Hunsdon), An Albanois (William Creitchton), Gentleman (Thomas Morgan), Coz. (Edmund Nevill). Parthenophil is probably Burghley, but only tenuous evidence is found. Even four anonymous characters in the last dumb show can be identified with historical persons accused of attempting the Queen's assassination.

The plenitude of historical detail is extraordinary. Dekker did not rely on popular notions of recent history, but reproduced the official versions of sources sanctioned or inspired by the government. Undoubtedly he thought he was doing a patriotic service in impressing upon his audiences the dangers of the realm presented by the Papacy and the Jesuits.

Finally, there is an examination of the structure — a combination of the polemical morality play with the chronicle history of the epic type; the characterization — indistinct but representing well-known persons; the imagery — integrated with background and theme; the verse — good rhetoric; and the racy prose. The play is not without literary merit; the basic imperfection is the capricious mixture of allegory and realism. But Dekker never aims over the audience's head; he always communicates. He hoped to establish himself with this drama as a writer on themes of high seriousness: it shows above all his patriotism and characteristic moral fervor.

Microfilm copy of complete manuscript of 294 pages, $3.68. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1477.

THE MEASURE FOR MEASURE OF SHAKESPEARE'S 1604 AUDIENCE

(Publication No. 5730)

Robert Gordon Shedd, Ph.D.
University of Michigan, 1953

This study has three purposes: (a) to reexamine the alleged facts concerning the play in order to separate the facts from critical opinions which pass for facts; (b) to set the play against its 1603-4 background to determine what topical values it may have held for its earliest known auditory; and (c) to relate Shakespeare's treatment of his sources to the 1603-4 background in order to discover what Shakespeare may have intended the play to mean for his 1604 audiences.

Part One establishes the framework of facts within which studies of the play should be pursued. Considered first are the relationships between scholarship and the two major traditions in the history of the criticism on the play: (1) the older view that it is an artistic failure reflecting Shakespeare's bitter disgust, and (2) the newer view that it is flawless and shows Shakespeare affirming his faith in Christian values. Reexamination of the Revels Accounts and the First Folio text reveals that the play has gained an undeserved reputation: it must have been deemed suitable for opening the 1604/5 Christmas Revels, and the text is sound and shows careful preparation for publication. Stylistic analysis reveals the play as Shakespeare's throughout. Generic analysis reveals it is unmistakably a comedy.

Part Two briefly surveys earlier attempts to uncover the topical values of the play. With few exceptions, they are found wanting because they reflect dangerous assumptions concerning Shakespeare's artistic development, the nature of the "Jacobean Age," and English attitudes toward James I. The events of 1603 and early 1604 are reconstructed: the peaceful accession of King James, the 1603 London Plague, the prospects for peace abroad, and the new ruler's unprecedented and carefully staged display of clemency at Winchester on 9 December, 1603. These events bear significantly on the way Measure for Measure would have been received in 1604.

Part Three questions the older source-studies on this play. Scholars who have accepted the play as a cynical reflection of Shakespeare "In the Depths" have over-emphasized Shakespeare's debts to his sources at the expense of his departures. His most important deviation is his expansion of the overlord, a minor figure in his sources, into the fifth largest part in the Shakespeare canon. All of Shakespeare's alterations suggest he wrote the play with his audiences' interest in Equity and Clemency uppermost in his mind. Three other plays acted in London in 1604 are examined for reflections of similar preoccupations: Rowley's When You See Me You Know Me, Marston's The Malcontent, and the revived The Merchant of Venice.

The conclusions proceed from the fact that Measure for Measure mirrors the events of 1603-4 and a heightened popular interest in the conflict between Justice and Mercy as dramatized by James I in the first acts of his reign. In 1604 audiences would have related the dramatic pattern of the play to their own recent experiences and, thus, would not have regarded it as bitter or unduly melodramatic in its contrivances.

Microfilm copy of complete manuscript of 430 pages, $5.38. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1478.

THE AESTHETIC FUNCTION OF RIME IN DRYDEN'S VERSE

(Publication No. 5734)

Giles Merten Sinclair, Ph.D.
University of Michigan, 1953

This is a study of the aesthetic function of rime in verse, with particular reference to the role it plays in Dryden's argumentative poems. Rime refers here to the poetic device as it is used in English poetry, and, while several of Dryden's poems are discussed, the focus of the analysis is Absalom and Achitophel.

The study surveys briefly the most pertinent attempts to define English rime from Puttenham to the present day in order to arrive at an adequate definition of rime and an acceptable basis for determining the functions of rime. Rime is defined as a feature of English verse in which the congruity in form of the end-words of verse units is brought to the reader's attention. Examples from several periods of English poetry are used to indicate that this congruity, while often one of terminal sound, generally phonemic, may also consist of other phonetic correspondences (assonance, consonance, or alliteration) or be a spelling likeness. The effect of rime is to bring the rimed units together in the reader's attention by a means independent of (but not necessarily contrary to) the rhetorical and grammatical structure. Thus rime creates a relationship other than logical between the rime words, although this relationship itself is modified by the syntax of the verse and the total meaning of the rimed lines. A consideration of these relationships is of importance therefore in determining whether or not a rime is a "good" one.

Dryden's early poems, particularly Annus Mirabilis, the rimed plays, and the prologues and epilogues are then examined to discover how far these functions of rime appear to be significant in Dryden's earlier verse and, in some measure, to trace the growth of a greater integration of the rime with other verse features from the early poems through to the later plays.

The detailed analysis of the rime in Absalom and Achitophel is made more objective by the establishment of a method for describing the relative degree of parallelism of the lines of the couplet. The relationships of the two lines are divided into three categories of (1) Coordination, (2) Subordination, and (3) Continuation. The parallelism of the rime words

is analysed on the basis of whether the rimes are the same or different parts of speech, and have the same or different number of syllables. In addition, other relationships of the rimes to each other and to the couplet are analysed. Parts of Dryden's other major poems and closely similar poems by Pope and Goldsmith are similarly analysed for purposes of comparison.

The results of the analysis show a greater use of the continuation form of the couplet by Dryden than by either Pope or Goldsmith. Similarly, Dryden uses more rimes in which the rime words are of different parts of speech and of different syllabic length than do Pope or Goldsmith. Both Dryden and Pope have a greater number of rimes which manifest special parallelism of either sound or meaning.

The study suggests that an evaluation of rime must take into account the meanings of the rime words as well as their sounds and consider their relationship to the verse units in which they occur, both in meaning and sound. The analysis of Dryden's poems indicates that a great part of his mastery of statement comes from the integration of the rime with the couplet.

A discussion of the probable phonemic congruence of the rimes in Absalom and Achitophel constitutes an appendix to the study.

Microfilm copy of complete manuscript of 185 pages, $2.31. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1479.

LANGUAGE AND LITERATURE, CLASSICAL

THE TEXT TRADITION OF ST. JOHN CHRYSOSTOM'S HOMILIES ON GENESIS AND MSS MICHIGANENSES 139, 78, AND HOLKHAMICUS 61

(Publication No. 4624)

Walter Alexander Markowicz, Ph.D.
University of Michigan, 1953

This work is a study of the tradition of the text of Chrysostom's Homilies on Genesis from his time to the present day. The ready availability of manuscript material in modern times through the use of microfilms makes it possible to investigate the editorial practice of earlier editors of Chrysostom. There are only three independent editions of the Homilies on Genesis, those of Henry Savile, of Fronton du Duc, and of Bernard de Montfaucon. None of these adequately utilized the available manuscript material and none evaluated the material it used.

Consequently this work collates forty three manuscripts from the Vatican Library, from the Bibliotheque Nationale, from the Bodleian Library, from the Holkham Hall, and from the manuscript collection of the University of Michigan Library. In the collation the manuscripts are studied to determine their possible relationship, a relationship which could be determined by a common sharing of omissions, transpositions, and substitutions. The study of the manuscripts in relation to the printed editions was also pursued in order to give an indication of their value and of the necessity of a new truly critical edition.

The sixty seven homilies which are the object of this study need to be studied in two portions: Homilies 1-30± and Homilies 30± - 67. Subsequently these will be called section one and section two.

The results of the collation demonstrate that the manuscripts fall into two distinct families. Families I and II have Chrysostomic authority. One is apparently the result of the independent publication of the homilies by stenographers. The other is Chrysostom's own corrected version. A third group or family arose which is an attempt at a harmony of one and two. Section one for family I is represented by seventeen manuscripts. Section two for family I is represented by seven manuscripts. Family II for section one uses seven manuscripts and for section two uses four manuscripts. Section one for group or family III is represented by five manuscripts. Section two for family III is represented by three manuscripts.

This study demonstrates the necessity of a new edition of Chrysostom's Homilies on Genesis. It further demonstrates that the source material falls into two distinct families of text and one group or family which is an attempted link between the two. A new edition must reflect these three families of texts if it is to be a scientific edition. The extent of available material necessitates a further limitation for the prospective editor. Further study showed the following as necessary for the new edition:

For section one:

Family I - Ms Holkhamicus 61
Ms Magdalensis Graecus 3

Family II - Ms Coislinianus 62

Family III - Ms Novi Collegii 71

For section two:

Family I - Ms Fontainebleau-Regius 1925
Ms Regius 2321

Family II - Ms Fontainebleau-Regius 1928

Family III - Ms Colbertinus 2997

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LANGUAGE AND LITERATURE, MODERN

THE PHONETIC BASIS OF FRENCH RIME: AN ARTICULATORY, ACOUSTIC AUDITORY STUDY OF RIME PREFERENCES

(Publication No. 5575)

Simon Belasco, Ph.D.
University of Pennsylvania, 1953

Supervisor: Pierre C. Delattre

This study applies the techniques of statistical analysis to the study of rime in an effort to determine whether the various phonetic properties of vowel and consonant sounds bear a definite relation to the rimes preferred by the French poets. The discussion of rime pertains to those cases where the riming vowel is only followed by a "single" consonant sound.

3956 "random samples" of rimes of nineteenth century French poets found in Canfield and Patterson's anthology of poetry, French Poems, were compared with a complete list of 18677 possible rimes (the statistical universe) in L. Cayotte's Dictionnaire des rimes.

The 3956 riming syllables gave a total of 12 different vowel sounds and 18 different "single" consonant sounds which combined to form 112 different kinds of rimes. To indicate "vowel color" and "consonant color" preferences, these data were reduced to group relative percentage values, i.e., to values using 100 as a base, and classified in subgroups according to the conventional articulatory and acoustic divisions of vowel and consonant attributes.

The sequences CVC, CCVC, and OVC are followed through the speech appartus from the point of origin in the chest to the point of issue. The sinusoid, harmonic analysis, Joos' glottal tone theory, and the decibel are discussed in relation to the phonetically relevant distribution of acoustic power among the frequencies.

Based on the experimental evidence of Georg von Békésy, the recent "place" theories of hearing favor the hydrodynamic interpretations propounded by Ranke and Zwislocki. Whatever the final cause of the stimulation of the sensory cells, the maximum deformation of the basilar membrane is an integral factor in producing such stimulation. The site of this deformation, a mechanical (peripheral) phenomenon varies from apex to base as the frequency of the sound stimulus increases. The sound stimulus is represented by the (maximum) amplitude of the pertinent frequency component (or components) within the pertinent speech pass bands, i.e., the peaks or humps of formants 1, 2, (and 3). The basilar membrane may be likened to a logarithmic (musical) scale — low frequencies near the apex, high frequencies near the base. The units of the scale are cycles per second not mels. Mels are subjective units and must take into account certain cerebral (central) processes if not some prior "sharpening process" of peripheral analysis. But the site of the maximum of deformation of the basilar membrane depends on mechanical factors and is a function of the stimulus frequency (in cycles per second). An examination of the frequency values of formant 2 of the first three preferred viwels [ɔ̃uo] are within the frequency range G4 to A4 (3 semitones) and formant 2 of the second three preferred vowels [ɛ̃ɸy] are within the range G5 to A5 (3semitones), exactly one octave higher on the musical scale. Formant 1 of each of the vowels [ɔ̃uo] approximates the frequency of either G3, F3, or B2 as does formant 1 of each of the vowels [ɛ̃ɸy]. These six vowels have a preference value of 72.72 percent.

The statistics indicate that preference for certain vowels and consonants appears to depend on their color, i.e., the relative position of their formants on the frequency scale as shown by a spectrogram. The most resonant consonants[lrm] show a low resonance bar very near formants 1 and 2 of the preferred vowels [ɔ̃uo] and [ɛ̃ɸy] and higher resonant bars near formant 2 of vowels [ɛ̃ɸy]. Where possible, the blending of these vowels and consonants in riming syllables produces esthetic color, tending to provide a maximum of auditory pleasure. The lack of vowel to consonant transition involves a minimum of muscular effort, tending to provide a maximum of muscular pleasure.

Microfilm copy of complete manuscript of 347 pages, $4.34. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1481.

THE POETRY OF STURGE MOORE

(Publication No. 5783)

William Edgar Bowers, Jr., Ph.D.
Stanford University, 1953

Sturge Moore is an almost exact contemporary of Paul Valéry and is important for the same reasons. Each was formed in the influence of Symbolist poetry, each began writing at a time when serious efforts were being made to recover from Romantic confusion, and each carried the recovery to its highest development. At a time when irrationality was considered to be most in conformity with human nature, Moore kept a rational and lucid mind; when it was believed that poetry should be written as an irrational description of sensation, he wrote rationally and coherently of moral distinction in human experience.

His poetry has been almost completely neglected. A lucid mind is always incomprehensible to a muddled mind, and, when it is believed that to be muddled is to be wise, there is little motive to correct confusion or to learn from one whose thinking is profound rather than obscure. Yet it is such minds on which we must depend if we are to comprehend evil and discipline our nature.

We can learn much from Moore's poetry, for it is concerned with the definition and the correction of the

evil of our own time. Much of this evil, when stated in traditional terms, we should immediately reject; however, because we know it in terms which we accept as "natural," we do not recognize it and therefore cannot truly comprehend it. Moore is valuable, therefore, because he defines evil in terms of our actual experience of it. In reading his poetry, furthermore, one can perceive what has happened to stylistic sensibility during the past two hundred years, for, though the themes are traditional and the thinking is logical, there is in the poem a quality of feeling which is the result of neither rationality nor coherence. Thus we may distinguish between the principles which are derived from principles judged to be fragmentary or dangerous, but which, nevertheless, are very likely to be ours also. A constant correction of both seems continually necessary.

In the first chapter, I discuss those aspects of Romantic doctrine from which Moore's work may be considered a recovery and show also in what terms the recovery was effected. The second chapter is meant to be a "guide" to the reading of the shorter poems. I show what the most important themes are and how they are connected with his characteristic approaches to his subject. The third chapter is concerned with the longer poems and the fourth with the plays.

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W. SOMERSET MAUGHAM AS A NOVELIST

(Publication No. 5458)

Allen Bischoff Brown, Ph.D.
State University of Iowa, 1953

This dissertation endeavors to determine W. Somerset Maugham's worth as a novelist by comparing five of his best-known novels, from various periods in his career, with eight other novels written about the same time. His first novel, Liza of Lambeth (1897), almost measured up to Hardy's Tess and outstripped Crane's Maggie; Of Human Bondage (1915) was very impressive and, as a novel, superior to the crusading and influential Way of All Flesh by Samuel Butler, far better than Walpole's Fortitude; Cakes and Ale (1930), although less a monument than Huxley's Point Counter Point, was also better than Maugham's powerful but crude Moon and Sixpence and Kennedy's challenging yet sentimental Constant Nymph; but Forster's masterpiece, A Passage to India, was much better than The Razor's Edge (1943) and Douglas's Magnificent Obsession.

Beginning as a disciple of Maupassant, Zola, and the writers about life in the London slums, Maugham's next seven novels were negligible. Of Human Bondage is his greatest achievement, but he steadily advanced in technical competence until he wrote Cakes and Ale. His next three novels (The Narrow Corner, Theatre and Christmas Holiday) are almost as good, but World War II exhausted his strength. He made a tremendous effort with The Razor's Edge, but failed. His last two novels, set in the past, are very slight.

Maugham, at his best, is a most able craftsman, but his range is small, his themes, characters, and situations are repetitive, and he has insufficient sympathy to be a great novelist. Although always a sober realist, he has never relinquished his great desire for religion and romance. Maugham does not belong in the first rank, but he is an interesting minor writer and certainly deserves the second.

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THE CONCEPT OF DEATH IN THE POETRY OF DONNE, HERBERT, CRASHAW, AND VAUGHAN

(Publication No. 5580)

Robert George Collmer, Ph.D.
University of Pennsylvania, 1953

Supervisor: Allan G. Chester

The purpose of this study is to consider the concept of death in the seventeenth century and to throw light upon the function of that concept as a poetic device in the poetry of four writers — John Donne, George Herbert, Richard Crashaw, and Henry Vaughan. More especially, the study examines the varied concepts of death in the poetry of these men against the background of the religious and philosophical writings of the period.

In the writings of the seventeenth century, references to death and related matters usually suggested meanings beyond mere physical dissolution. Both formal theology and mystical theology utilized the terminology of death metaphorically. The present work demonstrates that these figurative meanings for the word "death" fall into two categories. First, "death" can imply dissolution, separation, leaving, or annulling. Second, it can imply union with something or someone, and it can imply the achievement of spiritual heights.

The dissertation demonstrates the significance of the concept of death in several areas of thought. It had significance, for example, in ideas relating to the world of nature. Although none of the poets advances a developed theory of this significance, Donne often discusses the problem of dissolution in the natural world. The concept had significance also in thoughts pertaining to social relationship; the effect of death upon those who survive receives considerable emphasis in these poets, especially in Donne and Vaughan.

Even more important, perhaps, is the significance of the concept of death in religious meditation. Some entire poems, and many short passages in some poems

concerned with other topics, emphasize the value of meditation upon death as a means of spiritual growth. This emphasis is found especially in the poetry of Donne, Vaughan, and Herbert, less so in the poetry of Crashaw. Naturally enough, meditation upon death frequently leads to reflection upon the Christian doctrine of the resurrection of the body. This doctrine is given special prominence by those religious writers who, regarding the earthly body as corrupt, look forward to a glorified body which will be appropriate to a purified soul. Such notions as these play a large part in the poetry of Donne and Vaughan, a smaller part in the poetry of Herbert, and are excluded entirely from the poetry of Crashaw.

The religious writings of the seventeenth century often dwelt in lurid detail upon the physical act of dying, especially upon the ravages of the body and the distresses of the soul. Surprisingly, the poems have little to say about the effect of the act of dying upon the body. Donne and Vaughan, however, are realistic and detailed in their treatment of the spiritual agonies experienced at the moment of death.

No single attitude toward death can be traced in all four poets. Herbert expresses a moderate desire for death, but his desire is sharply limited by his submission to the will of God, whatever the consequences. Crashaw is concerned, not with physical death, but with the mystical death of union with God, for which he passionately longs. Vaughan's attitude is always associated with his hope for the future resurrection of the body and the reintegration of nature. It is impossible to trace any single attitude toward death in the writings of Donne. At times he seems to fear death; at other times he awaits it eagerly, even to the extent of contemplating suicide. Whatever his attitude, the thought of death is prominent in much of his poetry.

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VITO ALESSIO ROBLES: BIOGRAPHER OF MEXICAN CITIES

(Publication No. 5764)

Robert Oscar de Vette, Ph.D.
Florida State University, 1953

Supervisor: Margaret V. Campbell

Vito Alessio Robles, a contemporary Mexican historian, has written a number of works on history and politics and has also edited a number of documents of value to the investigation of Mexican history. Among his original writings are three volumes on the history and legend of three cities of Mexico: Acapulco, Saltillo, and Monterrey. The dissertation presents the author's biography and a study of the three volumes on the cities in order to show the contribution that Vito Alessio Robles has made to literature.

Born and reared in Saltillo, Coahuila, in northern Mexico, Alessio Robles attended the Chapultepec Military Academy in Mexico City, where he became a civil and military engineer. He was active in the military and political affairs of the nation from 1908 to 1930, serving in both the Federal and revolutionary armies. He was a newspaper writer and editor, deputy to the national Congress from the Federal District, senator for the state of Coahuila, and ambassador to Sweden. In later years he withdrew from the Federal army to pursue his private engineering practice and to carry on historical investigation.

In his childhood, Alessio Robles had developed a special interest in history and while still a young man he had begun a collection of documents and manuscripts on the history of Coahuila, his native state. Most of his writings were an outgrowth of his investigations in connection with his collection. In 1928 a visit to Acapulco aroused his interest in the city's history and he decided to write on the history and legend of the famous port. That work, Acapulco en la Historia y en la Leyenda, was published in 1932. Its success encouraged him to write a similar volume on his native city: Saltillo en la Historia y en la Leyenda (1934). In 1936 he added a third volume to the series: Monterrey en la Historia y en la Leyenda.

Each book is considered individually in the dissertation to show its content, the author's manner of writing, and his treatment of the history and legend of that city. The means that he employed to bring out the characteristics and atmosphere of each city is discussed and his purpose in writing is considered.

The comparison of the three works indicates the interrelation and the similarities that exist between them as well as the relation of the three works to Alessio Robles' other writings that preceded and followed them. It is shown that in the three volumes the author was not concerned with writing history as such but that he was seeking to combine history and legend in a narrative that would interest the ordinary reader. His use and arrangement of materials, the emphasis on persons and events, his presentation of the atmosphere of the cities, and his descriptions are also discussed.

On the basis of the study it is concluded that the three works must be grouped together and that they may not be classed simply as history or simply as legend. It is also concluded that in presenting the cities' stories — their founding, growth, and development, and their characteristics — the author has given each city a personality of its own. In the combination of history and legend he has written the city's life — its biography. In doing that he himself has become the biographer of Mexican cities.

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THE BURDENING OF NARRATIVE

(Publication No. 5463)

Dean Benton Doner, Ph.D.
State University of Iowa, 1953

The concept of fiction as a fine art, introduced into English and American literature most strongly through the works and theories of Henry James, is the the prevailing estimate of contemporary literary criticism. This judgment, mirroring the preoccupations of the modern novelist and story writer, is characterized by the titles of the important critical works: The Craft of Fiction, The Art of the Novel, "The Art of Fiction," The Art of Modern Fiction, The Structure of the Novel, Forms of Modern Fiction, and so on. There is good reason for calling ours the first classical period of the novel, for it is the classical temper which explores the potentialities and limitations of the genre, investigates the fit union of subject and technique, and attempts to elucidate the nature of the medium.

The novelists most clearly characteristic of this period have been both experimentalists and traditionalists: in exploring the potentialities of their genre, they have been disciplined by an understanding of the necessity for structure, balance, and form. As they were experimenters, they developed new techniques and burdened their narration with new methods and structures; but with their deep respect for the medium as a fine art, they experimented always within the strict limits imposed by their heightened awareness of the need for form. Their technical and structural manipulations were experiments not only in self-expression, but attempts to realize also the complete expression of the medium. I have chosen three novelists, Henry James, Virginia Woolf, and James Joyce, to investigate their specific burdenings and their methods of formalization.

Since these burdenings have been controlled by the necessity that the narratives be formalized, it was necessary to determine the nature of narrative form. In establishing the terminology of this study, I have used Ray B. West's and Robert Wooster Stallman's definition: form is achieved when the structure of events of a novel carries the structure of meaning. Form in narrative is then illustrated in the highly formalized A Passage to India and in the more loosely structured You Can't Go Home Again.

The burden investigated in the work of Henry James is his method. Through the use of a central, focusing intelligence, James achieved a structure of events (perceptions or apprehensions) which wholly carried the structure of meaning (comprehensions), as in The Ambassadors, in which the growing comprehension of Strether is at once the events of the novel and its meaning.

Virginia Woolf burdened her narration with a heightened style conveying the impressions of an ordinary mind on an ordinary day. When she learned to use these impressions as the structures of both the events and the meanings, her special subject was given narrative form. But before these impressions could be formalized in narration, it was necessary to get them "on stage," in other words, to make them the structure of events so that they could carry the structure of meaning. From this investigation, I understood that the structure of events which narration required was a horizontal structure achieving its power through the creation of horizontal tensions and realizing its form through the resolution of these tensions.

Finally, the so-called spatial form of Joyce's work was investigated. It became further clear that Joyce's novels were not examples of spatial form, but they are structures of "expanding symbols," events, impressions which have a narrative form. And thus the basic nature, a basic requirement, of the medium was illuminated: form in fiction can be achieved only by the resolution of the horizontal tensions inevitably present by reason of the nature of the medium. That these tensions may be established through such "events" as the growing awareness of a mind or in the expanding of a symbol is now apparent as a result of the experimentation which these modern novelists have practiced.

Microfilm copy of complete manuscript of 332 pages, $4.15. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1486.

IMMEDIACY, SUSPENSE, AND MEANING IN WILLIAM FAULKNER'S THE SOUND AND THE FURY: AN EXPERIMENT IN CRITICAL ANALYSIS

(Publication No. 5665)

Ralph Dunbar Eberly, Ph.D.
University of Michigan, 1953

The purpose of this study is to describe a method of criticizing fiction and to apply it to William Faulkner's The Sound and the Fury. This method consists of evaluation based upon coordinated, intensive analysis: its object is to show how the major narrative techniques used in a short-story or novel affect reader-interest. The need for such a method arises from the variety and intricacy of the devices that fiction-writers employ and from the difficulty of arriving at valid judgments by considering only random aspects of fiction.

Chapter I of the study sets forth the method in detail. First, two related assumptions are presented: that fiction aspires chiefly to capture the reader's interest and that the critic can profitably use interest as a criterion. Interest has at least three major components: immediacy, suspense, and meaning. "Immediacy" is the reader's response to fictional events almost as if they were emotionally charged experiences of living persons; "suspense" is his desire for information that the novel temporarily withholds; and "meaning" is his awareness of the book's total comment upon the "actual" world. The effects of various narrative techniques upon immediacy, suspense, and meaning are described in

detail. It is maintained that analysis of a novel's creation of immediacy and suspense leads directly to evaluation: the greater the immediacy or the suspense, the greater the interest. The study of meaning, however, requires two steps: first determining what the meaning is (making due allowance here for range and tone), and then evaluating that meaning. For this evaluation two criteria are suggested: complexity (the variety of aspects of human existence reflected in the total meaning of the novel, and, within each of these areas, the range and adequacy of the comment) and coherence (the integration of the various aspects of meaning and their freedom from internal contradictions.

Chapter II illustrates the method by analyzing The Sound and the Fury, a novel sufficiently complex and sufficiently controversial to provide a good test; the major narrative techniques of this book are examined in their relation to immediacy, suspense, and meaning. The examination indicates that by using specific narration almost continuously, by concentrating time, place, and means of perception, and by making skillful use of spiral movement, dialog, and evocative detail, this novel creates a powerful immediacy. The Sound and the Fury appears less successful, however, in producing suspense; even sympathetic readers may object to certain unnecessary confusions. In its total meaning the book bids strongly for the reader's interest: by commenting upon sociological, psychological, ethical, metaphysical, and theological aspects of the "actual" world and by achieving a wide range and a high degree of adequacy in most of these areas, it gains a satisfying complexity; and (with one important exception) it interweaves its meaning coherently.

Conclusions about the value of this method of criticism will depend upon the contribution that it makes to the reader's understanding and appreciation of The Sound and the Fury and upon the results obtained when the method is applied hereafter to other books.

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RING LARDNER: A CRITICAL SURVEY

(Publication No. 5590)

James Richard Frakes, Ph.D.
University of Pennsylvania, 1953

Supervisor: Sculley Bradley

Ringgold Wilmer Lardner (1885-1933), American short-story writer, columnist, playwright, and humorist, began his career as a sports writer; his first popular success, You Know Me Al (1916), was an extension and amplification of his "In the Wake of the News" columns for the Chicago Tribune, and in this series of letters from a bone-headed busher, Lardner's reputation as a debunker of popular idols and sacrosanct mores, as humorist, and as comic philologist, was firmly established. Heralded by such critics as H. L. Mencken and Gilbert Seldes as a savage commentator on American society and an author of no mean dimensions, Lardner was finally discovered by his second audience, the intelligentsia, upon the publication of How to Write Short Stories in 1924. From that time until his death in 1933, he never lacked for recognition and praise, both for his transcription of the American vulgate and for his penetrating analysis of the debilitating effect of contemporary materialistic philosophy and cultural pretensions.

Lardner's world is not a pretty one; writing ostensibly about ball players, song writers, producers, fighters, and Long Island socialites, he depicted with a merciless accuracy the larger world of hypocrites, social climbers, liars, cheats, and phonies. His characters were ruined by success, lacking as they did any sense of values other than mercenary ones and endowed with an egotism that forbade self-doubt or even self-scrutiny. The personal relationships in his stories resolved into conflicts of stunted personalities, perpetual bickering, vacuous conversations, sarcastic exchanges, and sub-surface hatred. His pictures of married life — in Gullible's Travels, The Big Town, "The Love Nest," "The Golden Honeymoon," and June Moon — are among the most devastating ever drawn; there is no love because there is no understanding and because none of his characters can escape from the confinement of his self-absorption. If his men are stupid and conceited, his women share these qualities and are also enamored of wealth and prestige, scheming, garrulous, fickle, shallow, and spiteful.

Prudery runs like a scar through all of Lardner's writings. This concern with modesty of action and speech intrudes itself into some of his best works, creates disharmony in the veristic speech-patterns pf his "puppets," and evolves into a pitiful crusade against suggestiveness in the radio criticism that he wrote for The New Yorker just before his death.

Except for his failure to record profanity and obscenity, Lardner's handling of the American language is unsurpassed in literature. Indeed, some critics have praised his flawless ear to the detriment of his handling of plot and character.

As a social satirist, Lardner is both bleaker and more incisive than Sinclair Lewis. His poker-face approach to the foibles and emptiness of our society revealed an acid hatred that verged on misanthropy. But nowhere is there evidence of any desire to reform — the earmark of the classical satirist — and Lardner remained to the end a man without a program for the improvement of the society he castigated.

Despite his continual efforts at self-depreciation and his evident refusal to take either his works or himself seriously, and despite his mass-production methods, limitation of theme, repetition and topicality of comic devices, Ring Lardner is secure in his position as American fiction writer, humorist, and master of the vernacular. He has been over-praised at times, misread at others, and frequently dismissed as a mere "funnyman," but he remains a skilled

professional writer and an unrivalled anatomist of the less savory aspects of our civilization.

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THE GENESIS OF THE ARNOLDIAN CRITIQUE

(Publication No. 5794)

James Wright Frierson, Ph.D.
Stanford University, 1953

My purpose is to analyze all of Matthew Arnold's essays in literary criticism inductively in the light of his letters and other writings in order to show their philosophical basis in the Christian humanist tradition and to demonstrate their consistency with classical literary precepts.

A major hypothesis of my thesis is that Dean Stanley's Life and Correspondence of Dr. Arnold (which ran through seven editions between 1844 and 1852) profoundly influenced the course of Matthew Arnold's thought during his most crucial years. Incidentally I attempt to show that neglect of this central document for study of the Arnolds has cost eminent scholars some factual errors.

Of recent commentators Trilling alone gives adequate consideration to the affinities of Matthew Arnold's thought with that of Dr. Thomas Arnold; yet Trilling, I believe, errs in occasional critical interpretations through failure to place father and son in their proper historical perspective.

Again, failure to appreciate the Arnoldian humanistic approach to literature has tended to obscure the nature and extent of the influence of Sainte-Beuve on Matthew Arnol's literary criticism. Beginning in 1849, the Causeries du Lundi gave direction and orientation to Arnold's literary development without infecting him with Sainte-Beuvian scepticism. Proximately, Sainte-Beuve's influence was most important in reinforcing Arnold's adherence to the classical and critical sides of Goethe.

At first, perhaps in response to his personal need for order, clarity, and direction, Arnold's classicism becomes academic and excessive, leading to the suppression of Empedocles and the publication of the "savant et mort" Merope. But the insistence on standards, the concept of adequacy, and the doctrine of creative imitation make the Preface of 1853 still "stand" as a landmark of critical theory.

Because his critique was grounded on Christian humanist ideals and informed by classical principles, Arnold was enabled to withstand and to transcend the positivistic Zeitgeist of mid-century criticism, and to resist its later degeneration into naturalism and impressionism. In the 1860's he often followed Sainte-Beuve in choice of subject and at times borrowed ideas from him and from Goethe; but always his main concerns are for the moral purpose of art, the exalted role of the poet in a "modern" epoch, and the judicial function of criticism. Heinrich Heine announces the important theme of rational regret for the waste of great powers which illuminates Arnold's attitude toward Coleridge, Keats, and Shelley; it likewise sets forth the humanistic view of the man of letters which bears on Arnold's verdicts concerning Byron, Wordsworth, and Emerson, and negates, as I think, E. K. Brown's position in Matthew Arnold: A Study in Conflict.

Arnold's last decade of literary criticism begins and ends appropriately with studies of John Milton, whom Douglas Bush has called "the last great exponent of Christian humanism in its historical continuity." In Johnson's Lives Arnold establishes the "point de repère," analogous to the working hypothesis in scientific investigation, but also allied to the classical doctrine of creative imitation. It is according to this tentative method, yet essentially judicial critique, that the famous touchstones are suggested.

The main importance "to us" of the Arnoldian critique is that it demonstrates the flexibility and adaptability of the classical tradition in a changing world.

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HENRY JAMES: THE LATE AND EARLY STYLES (A STYLISTICS STUDY)

(Publication No. 5678)

Leo Thomas Hendrick, Ph.D.
University of Michigan, 1953

This study has a twofold aim: first, to describe, in specific terms, the unique "later prose style" of Henry James, i.e., to give stylistic grounding to generally felt impressions like "complexity," "ambiguity," "metaphoric richness," "metaphysical tone," and so on; second, to explain, as far as possible, what caused the Jamesian later style.

The first aim, the description of the later style, seemed best accomplished by a contrast with James's own early style. To this end, I isolated various frequently-recurring stylistic phenomena in selected passages from the fiction written after 1900 and measured them, both quantitatively and qualitatively, against the same phenomena in passages from the fiction written before 1880. The second aim, the explanation of the later style, was based on the following assumption: that of the multifold shaping influence of style, the three most important for a novelist are (1) his subject matter, (2) his narrative method, and (3) his personality or sensibility.

The divisions and conclusions of this study are as follows: James's later non-dialogue style (Chapter I) is characterized by density (more words and word-groups per sentence than in the early style), by complexity (more and longer dependent constructions than in the early style, more repetition, more

parallel clusters, and more personal pronouns), and by irregularity (consistent violation of normal syntax through "interrupters," broken parellelism, and chains of statement followed by re-statement). The later dialogue style (Chapter II is intellective (with a relatively high proportion of questions, of ambiguous "structure" words, and of "cognition" words); it is stichomythic (adhering much more closely than the early dialogue to the stylistic contours of classic stichomythia); it is tentative (halting frequently for clarification, and having many dashes and interrupters); and it is non-constructive (marked by wider dispersion than the early dialogue, by a transferred emphasis to the dialogue-guides, and by fewer "action" words). The later imagery (Chapter III) is relatively complex (the later James, much more frequently than the early, picks up structurally simple images and develops them into "branching," "chained," or "antithetic" images).

Many of James's explicitly-stated artistic principles — from his criticism, letters, and other nonfiction — appear in casual relation to his later style. Thus, his late subject-matter (acute, receptive minds; complex, bewildering situations; subtle human relationships, etc.) accounts for some aspects of his style. And his narrative method (the point-of-view; foreshortening; gradual revelation; etc.) accounts for other aspects of his style. Moreover, (Chapter IV) the mature James's vision of reality, his irony, his grandiose courtesy, etc. — all these influenced his style. Since the above causes — or remarkably similar ones — operated, with increasing intensity from the beginning to the end of James's writing career, it is not surprising that the early style develops into the late and that the later nonfiction is stylistically of a piece with the later fiction.

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THE HISTORY OF THE GERMAN NEWSPAPERS OF ONTARIO, CANADA, 1835-1918

(Publication No. 5685)

Herbert Karl Kalbfleisch, Ph.D.
University of Michigan, 1953

The purpose of this study is to trace the history of the German newspapers of the province of Ontario, Canada, from their inception in 1835, until their disappearance in 1918. Implicit in this study is an evaluation of the part played by the German newspapers in providing reading material of a literary and poetic nature for their clientele; the efforts that were made by them to keep a racial and cultural consciousness alive in the German communities served by them; the part they played in assisting the new German immigrant to fit himself into his new environment; the extent to which they responded to the presence of the Pennsylvania Germans in Ontario German communities; and, finally, to assess their value as news disseminating, advertising, and editorial media.

The newspapers have been treated individually in chronological order, in so far as that was practicable. The extant files of the newspapers were used as the chief source material. It is unfortunate that gaps and, in a few cases, a complete absence of files, has rendered the treatment of several newspapers brief and sketchy. However, this does not apply to the leading German newspapers, which are represented by excellent files, for example, the Berliner Journal is complete from 1859 to 1918, with only one year, 1910, missing.

Secondary sources provided some material for this study. Their chief value, however, was in getting a better picture of the personalities of editors and publishers of the German newspapers. Very little about the newspapers themselves has been written.

The results of this investigation very adequately substantiate the basic aspects of the problem. The German newspaper press of Ontario supplied belletristic material to its readers at a time when German books and libraries were unavailable to them; they advocated a strong adherence to the cultural and racial traditions of the Fatherland; at the same time, however, they assisted the German immigrant in becoming acquainted with the traditions of his adopted country; the Pennsylvania Germans in Ontario were not neglected by the German newspapers which were, in the main, published and edited by Reichsdeutsche; and, finally, the German newspapers made a splendid attempt to provide a week by week commentary on foreign and domestic events, and to serve their local communities with an advertising medium.

Not until shortly before 1900 did the German newspapers in Ontario become, in part, the vehicles of local gossip. And while they stood editorially for the preservation of the German tongue and German customs in the more intimate phases of life in the German communities, in the larger sphere their attitude was strongly Canadian.

Although eventually prohibited by law in 1918, the German newspaper press in Ontario would have experienced, without this legal restraint, some difficulty in maintaining itself indefinitely. It had passed through the various stages of a modest beginning in 1835, a flourishing period between 1850 and 1900, the period of amalgamation between 1900 and 1909, and the last, and fateful years 1909 to 1918, when the number of German newspapers was reduced first to two, and finally to one.

Fusion and assimilation of the Germans in Ontario, accelerated by the impact of the first Great War, was slowly but definitely reducing the numbers of those who could be potential German newspaper readers, thereby rendering the German newspaper press itself unnecessary.

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SOME STUDIES IN THE SHORTER POEMS OF ROBERT BROWNING: STYLISTIC INTERPRETATIONS

(Publication No. 5689)

Roma Alvah King, Jr., Ph.D.
University of Michigan, 1953

I propose to make a critical study of five of Robert Browning's shorter dramatic monologues, describing and evaluating (a) the poems and (b) his achievements in that genre.

Because these poems provide both materials for analysis and a basis for generalizing about the poet as a writer of monologues, the following are discussed: "Andrea del Sarto," "Fra Lippo Lippi," "The Bishop Orders His Tomb," "Bishop Blougram's Apology," and "Saul."

Regarding the monologue itself as the object of my study, I refer only incidentally to its biographical origin and to its possible social and moral effects upon the reader. Literary judgments require that the "thought" be treated primarily as it produces character, creates conflicts, and intensifies dramatic action.

The monologue is "dramatic," each speaker providing a possible perspective, by no means necessarily Browning's own, from which a problem may be viewed. In general, the speaker is not the poet but a part of the world created within the poem.

I treat matter, structure, and meaning. Matter includes elements out of which the poem is made (sensuous, emotional, intellectual); structure, the devices which arrange matter in artistic form (diction, sentence structure, sound repetition, imagery, paradox, irony). Meaning is the end resulting from the union of matter and structure — it is matter completely expressed, incarnate in structure.

My judgments are made on two bases: the degree of unity achieved within the poem; the scope and intensity of the monologue. Each of the five poems is analyzed stylistically, and, with the exception of "Saul," discovered to be a unified artistic expression.

Certain qualities distinguish Browning as a writer of monologues. His matter is characterized by situation, character, and ideas presenting conflicts; subordination of situation and idea to character. He is attracted to the incongruous, sometimes the grotesque in situation, and to failure and psychological abnormality in dramatis personae. Alone among nineteenth century writers he introduces humor into serious poetry. Essentially a sceptic, Browning approaches problems from a variety of positions, juxtaposing one against the other, suspending a personal commitment. Hence the dramatis personae.

Four traits, it would seem, characterize his structure: precisely formulated ideas and emotions; a fully developed speaker with a compulsion to communicate to an adequately characterized listener; colloquial tone, structure, and cadence; unity that is a tense equilibrium of opposing forces.

It is Browning's achievement that he uses matter and structure with singleness of purpose to express a comprehensive mode of seeing, and that he succeeds in reconciling opposing forces. Irony, his central attitude and most effective device, permits him to unify counteracting forces without sacrifice of artistic detachment. Irony places his poetry in the tradition of wit.

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RHETORIC IN AMERICAN COLLEGES, 1850-1900

(Publication No. 5899)

Albert Raymond Kitzhaber, Ph.D.
University of Washington, 1953

By the time of Hugh Blair and George Campbell, the most prominent British rhetoricians of the eighteenth century, the tradition of classical rhetoric had become tenuous. The rhetorical systems of these men, which were destined to be the source of a new tradition lasting nearly a century, were elaborate theoretical structures centered chiefly around written composition and grounded in eighteenth century faculty psychology. Since American educational theory until well past the middle of the nineteenth century was based on a theory of mental discipline that presupposed a similar psychology, Blair's and Campbell's books were well adapted for use in American colleges, where they remained standard texts until the Civil War.

The earlier American rhetorics, which began to appear in quantity after 1850, were little more than revisions of the British texts. In the seventies and eighties, however, as American education took on a more practical cast to adapt it to contemporary conditions, rhetoricians tried to accommodate rhetorical theory to the new educational philosophy. Their success was only partial, for they made no real break with the abstract approach of the earlier writers, chiefly simplifying traditional theory by deleting its less practical features. Though there was much talk of the importance of practice in writing, the texts of these years showed little actual understanding of the writing process.

As the educational reform movement reached its climax in the 1890's, rhetorical theory became for a short time somewhat more vital. There was an effort to combat the notion of rhetoric as primarily an academic exercise and to establish it as a discipline serving an essential function in society. This attempt did manage to discredit many aspects of the eighteenth century rhetorical tradition, but it did not last long enough to allow the formulation of a comprehensive new system of theory to replace the old one that had been abandoned.

A main reason why the new ideas were so quickly buried was a sharply increased emphasis on

correctness in the mechanical details of writing, a tendency stemming partly from the widespread imposition of college entrance examinations in English and greatly reinforced by the widely publicized "Harvard Reports" on composition and rhetoric issued in the mid-nineties. As this ideal of mechanical correctness became the primary goal of composition teaching, rhetorical theory was reduced to little more than rules for paragraph construction, and two sets of abstractions: Unity, Coherence, and Emphasis; and the "Four Forms of Discourse." All three of these items of theory encouraged a mechanical conception of writing, a view of writing as a classroom exercise without social implications.

With the restriction of rhetoric to the business of teaching the mechanics of writing to freshmen, the subject rapidly lost status. Isolated in the curriculum and cut off from its vital relations with other disciplines, it offered no professional advantage to those men of ability who might have given it new vigor. It was delegated to graduate students and junior instructors, who generally looked on their composition teaching as a period of probation before being assigned to literature classes.

The period of 1850-1900 was certainly not a distinguished one in the history of rhetoric. At the same time, however, the last fifteen years of the century saw the development of modern courses in freshman composition, the formulation of rhetorical categories that only in recent years have begun to be questioned, and the establishment of mechanical correctness as the chief aim of composition teaching, a view that is still perhaps the most widely accepted of any. The period is, therefore, of some significance in furnishing the background for work in composition today.

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SOME SATIRICAL POETS OF THE SPANISH AMERICAN COLONIAL PERIOD

(Publication No. 5691)

Glen L. Kolb, Ph.D.
University of Michigan, 1953

Since the satirical genre is essentially a literature of protest, it constitutes an expression of some of the strongest sentiments and emotions found in the writings of any period; as such, it offers an important and useful key to the study and understanding of the social attitudes of a group at a given historical moment. A large quantity of satire was produced in Spain's American possessions during the colonial period, but no comprehensive study of this literature has yet appeared. This dissertation analyzes the poetry of a group of representative satirists in various parts of the colonies, from the sixteenth century to the period of Independence, in order to determine their motivations and the artistic and historical value of their writings.

The principal writers and types of satire treated in this study are: in the sixteenth century, the anti-American invective of the Spaniard, Mateo Rosas de Oquendo; in the seventeenth century, Juan del Valle y Caviedes, who attacked the medical quacks of Lima; and Sor Juana Inés de la Cruz of Mexico, writer of feminist satire; in the eighteenth century, the anti-Peruvian diatribe of Esteban de Terralla y Landa; the inter-regional invectives of Juan Manuel de Lavardén and Juan Bautista Aguirre; and a quantity of satirical verse of a personal nature by Chilean clerics and anonymous poets; in the nineteenth century, the social satire of Anastasio Ochoa of Mexico; and the journalistic lampoons of the Peruvian, Joaquin de Larriva.

The objectives of this study are: first, to determine the motivations of each writer by a careful examination of his work in relation to known biographical facts and the circumstances of its composition; second, to analyze his satirical technique and poetic style; third, to draw a composite picture of his personality based on the ideas and attitudes expressed in his writings; and fourth, to evaluate his work in relation to that of the other satirists and to colonial poetry as a whole. The critical method is that of description followed by analysis and conclusion. The treatment of each poet, or group of poets, is preceded by a historical sketch intended to provide a general impression of social conditions, religious and political climate, and intellectual currents of the author's time. Six special bibliographies are provided to serve as a record of research to date on the poets discussed here.

The writings of all these satirists are valuable as an aid to the study of Hispanic colonial culture. Several of them, particularly Caviedes, also deserve recognition for positive literary merit.

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THE NOVELS OF E. M. FORSTER

(Publication No. 5484)

James Rodney McConkey, Ph.D.
State University of Iowa, 1953

E. M. Forster is not a mystic, nor is he, on the other hand, the novelist of ideas, although he has been praised for, and accused of, being both. The voice we hear as we read him is not that of one who has pierced the heavens, nor that of one who primarily engages, as man, to discuss the ideas needful to our proper existence on earth; it is rather that of a mediator, neither God nor man, who carries on from a mid-point between the two: knowing less than one, perceiving more than is normally possible for the other.

The Forsterian voice, as we sense it, is to a large extent the result of a point of view which focuses upon the characters from that mid-point; the unique effect of Forster, in fact, comes from his

mediation as voice, detached, perhaps painfully, from the physical and transcendent worlds, aware of the incompleteness of his people and the completeness beyond them. Since the physical and transcendent worlds are apparently so disparate, and since the mediator cannot unlock the secret of the latter for us, the chief means at his disposal are symbolic ones, symbols which are intended to suggest and imply the relation, so dimly perceived by us, between us and the transcendent world.

Yet, in spite of its attempt at mediation, the Forsterian voice has always been in at least partial opposition to the Forsterian thematic suggestion that man, through earth and place, can obtain a harmonious relation with other men and with the physical world; for, whenever his characters have gained the experience and intuitive power necessary for such a harmonious relation, they begin to mount to that solitary and detached position which is also their author's. What this suggests is the paradox which has faced Forster throughout his novelistic career. Concerned as he is with the world of human relations, his awareness and perception of that world comes from his own remove from it, his refusal or his inability to enter actively into those relations.

In his last novel, A Passage to India, Forster is not only keenly aware of that paradox, but has accepted it; as result, the Forsterian voice, instead of opposing the other aspects of the work, manages to enrich and substantiate them, and Forster himself has finally been able to come to terms with himself and his universe. Those terms are imparted to us most completely in the novel through the character of Professor Godbole, the Brahman Hindu. With the major concepts of Hindu philosophy Forster has always displayed a basic, if unconscious, affinity, and Godbole, is the only person in all the novels who becomes the character-equivalent of the Forsterian voice. The position of Godbole is that of detachment from the human reality and from the physical world, a detachment obtained by as full a denial of individual consciousness as is possible — that denial and remove bringing with them a sense of love and an awareness of unity. As is true of the Forsterian voice, a full perception of the transcendent reality is denied him, and a full awareness as well of the unity within the physical world; but the achievement, although partial, is still a victory, and as great a victory as is possible for mankind, in the Forsterian cosmos, to achieve.

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POEMS OF PAPER FISH AND LANTERNS

(Publication No. 5487)

George Murray Nauss, Ph.D.
State University of Iowa, 1953

Moving up into Japan from Okinawa after the Japanese surrendered, the author, then a lieutenant of engineers, served in the occupation forces the better part of a year. Karl Shapiro, under whom he studied poetry writing as a graduate student at the Johns Hopkins University several years after his return from Japan, urged him to try poems describing the life of the Far East and often said the first attempts were worth publishing. The author, however, looked upon them only as a private hobby and continued polishing and adding to them while studying poetry at the State University of Iowa under Robert Lowell, Paul Engle, and again Karl Shapiro. The author this year (1953) has had a second opportunity of studying under Mr. Lowell,and it is with his help and encouragement that the volume has been put together.

None of the poems employs regular meter, and in the few instances where rhyme is used, it is kept very unobtrusive. An original style has been sought using a long, flat line with the incisive lucidity of prose but poetic in imaginative figures, richness of detail and color and sonorous phrasing.

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THE COMIC SPIRIT IN THE ART OF HERMAN MELVILLE

(Publication No. 5616)

Edward Hoffman Rosenberry, Ph.D.
University of Pennsylvania, 1953

Supervisor: R. E. Spiller

Though Melville's books have been read primarily as tragedy, the major output of his professional literary career (1846-1856) was instinctively shaped by an ambiguous comic spirit — his "infirmity of jocularity" — through which he saw the world as "half melancholy, half farcical." His artistic intentions, problems, successes, and failures may be measured in terms of the deepening levels of comic art through which he passed from Typee to The Confidence-Man, after which he significantly abandoned comedy and professional authorship together.

The first stage of Melville's development is seen in the early travel romances — Typee, Omoo, Redburn, White-Jacket — which are predominantly comic in a jocular-hedonic vein, characterized by a modified frontier-type humor. The two latter romances reveal in addition certain maturing influences from the intervening composition of Mardi, notably in the greater incidence of irony and satire, metaphysical

or multi-level jests, and puns used for ambiguous effect.

In Mardi Melville undertook a momentous experimental expansion of his powers, progressing in unintegrated sequence from jocular-hedonic beginnings, through an imaginative-critical type of comedy which encompasses the thoughtful laughter of satire and poetic whimsy, to a philosophical-psychological level of comedy where the nature of the comic and tragic visions is explored in the search for a valid balance of the "dark" and "bright" views of life. On the second level the growing complexity of Melville's art is signaled by his broad use of literary models (chiefly Rabelais and Shakespeare) and of ambiguous devices such as puns to extend the range of his comic vision. The third level, the plane on which comedy meets with tragedy, is attained through the medium of diabolism and a demonic theory of humor.

In Moby-Dick Melville's powers culminated in a unique integration of the three primary levels of comedy. The jocular element, in which literary influences subserve the controlling tone of folk laughter, provides the narrative with buoyant realism. The analogic and satiric elements, operating through puns, the whale-man metaphor, etc., endow it with inexhaustible intellectual and emotional overtones. And the profoundest philosophical and psychological meanings of the novel are suggested in the closely patterned interplay of Stubb, the over-comic; Ahab, the under-comic; and Ishmael, the sanely comic. On the highest level of comic art, the dramatic-structural, Moby-Dick adapts the methods of Shakespeare to perfect the theatrical pacing of its narrative and to achieve the epic magnitude of its theme.

The succeeding novels and storues were, with the exception of "Bartleby," unable to recapture this classic blending of forces. The polar ambiguities of Pierre and The Confidence-Man (modeled on Hamlet and Tristram Shandy respectively), the themes and structures of many intervening stories, and an interest in Hawthorne's romantic diabolism reveal an absorbing and unsatisfied concern with the problem of "bright" versus "dark." At the same time, a sharp increase in the critical tone of Melville's comedy is displayed in the prominence of satire in the work of this period, particularly in the sequence of attacks on Emersonian transcendentalism extending from Pierre through The Confidence-Man. Finally, a reconsideration of Melville's attitude toward his early work, a revaluation of the comic folk theme of dupe versus trickster which runs through these later works, and the casting of new light upon the stories of 1856 make it apparent that Melville resigned his failing career in letters, not in a smoldering pall of defeated misanthropy, but in an unappreciated blaze of native wit and humor that illuminates the primacy of his comic milieu and accomplishment.

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POPULAR ELEMENTS AND THE IDEA OF JUSTICE IN THE COMEDIAS OF LOPE DE VEGA

(Publication No. 5815)

Consuelo Willard Seymour, Ph.D.
Stanford University, 1953

The dissertation is divided into two parts. Part I contains three chapters; these deal with the altruistic principles revealed in Lope de Vega's personality, in his dramatic art and theories, and in his dramatic world.

Part II contains seven chapters. The first chapter is concerned with the poet's definite interest in utilizing the important manifestations of Spanish tradition, such as traditional ballads, popular poetry, folk songs, proverbs, and popular beliefs and superstitions. The second chapter is devoted to popular elements in Lope's religious plays, including the autos sacramentales. The third chapter deals with traditional festivals and customs of the seventeenth century Spain as presented in Lope's plays. The fourth chapter analyzes the servant and master relationship, the development of the gracioso, and the gracioso and his congeners. The fifth chapter is concerned with Lope's evaluation of the social status of women. The seclusion of women, the question of desertion, and Lope's plea for the moral emancipation of women are discussed. The sixth chapter, which is devoted to the theme of aldea versus city and court, stresses the poet's criticism of courtly customs and manners and his praise of the simple life of the country people, with their songs and dances, wholesome ideas, and reverence for religion. The seventh chapter is concerned with the struggle between the people and the nobles, in which the people ally themselves with their monarchs against the nobles to attain freedom from fear and abuse.

The dissertation seeks to demonstrate that the personality of Lope de Vega reveals certain altruistic features, such as his Christian spirit, his great friendliness and geniality, and his preference for the common people, rather than for the aristocracy. Lope's public was interested in having popular elements included in the comedia, and Lope complied willingly. The dramatic formula of Lope is not characterized by any uniform manner or by any specific method, for he was a great improviser, as well as a great innovator, whose impulses were not controlled by conscious reasoned processes. His technique appears to have been acquired through an intuitive process, which underwent constant change, as the poet observed his work on the stage. Throughout his career, however, he never veered from his fundamental policy of taking into consideration the wishes of his public.

Lope's metrical system is broad and varied; he continuously tried new meters and combinations, native and foreign, traditional and erudite. But it is also clear that the popular meters — the redondilla, décima, quintilla, and romance — were much favored by Lope.

The world of Lope reflects the moral principles and attitudes of the typical Spaniard of his age: the union of the people with their traditional past; the patriotic and religious feelings; the idealistic tendencies of the caballero; the nobility of Spanish womenhood and the particular honor code adopted by Spanish women; the general concept of love, and the attitude toward jealousy, which was linked with honor; the peasantry and their scale of values; the advantages of the simple country life and the disadvantages of the artificial life of the city and court; and lastly, the people's respect for, and trust in, the justice of their monarchs. Lope de Vega champions the ideals of the Spanish people, and reveals his complete accord with their sentiments, desires, prejudices, and outlook on life; his work shows the blending of Lope's personality and the tastes of the Spanish people.

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THE DESIGN OF CYMBELINE

(Publication No. 5744)

Homer D. Swander, Jr., Ph.D.
University of Michigan, 1953

This study is based upon the belief that if we are fully to appreciate Shakespeare's plays, we must understand the nature of their construction. The purpose of the study is to examine the construction of Cymbeline — a play complicated by an odd lack of orthodox suspense, an absence of any great character study, an unusual number of actions, and a unique mixture of times and places — in an attempt to discover if, in spite of such complications, it possesses a unity of design controlled by a single, significant point of view.

After a short history of the play and of the criticism it has inspired, Part I confines itself almost exclusively to an examination of the love story of Imogen and Posthumus — the story, essentially, of the wager — for it is in the working-out of this story that Shakespeare transforms the most crucial tragic threat into the comic or romantic reality. Throughout the study the primary emphasis is always upon the evidence that Shakespeare provides within the play itself; but especially in Part I this evidence is considered against a background of the important conventions with which he was working — the conventions, that is, of tragicomedy and of the vast cycle of stories involving a woman falsely accused, like Imogen, of infidelity. Both the imagery and the dramatic action — especially the repeated, explicit contrasting of Imogen and Posthumus — and, in addition, the use and violation of important conventions contribute to the conclusion that in Cymbeline Shakespeare does not avert potential tragedy merely but, in the character of Posthumus, expressly repudiates the conventional tragic values and, in the character of Imogen, portrays a heroine who, through the complex dramatic revelation of her faith and love, creates the sense of a universe in which tragedy is utterly impossible.

Part II then proceeds to a consideration of the way in which Shakespeare brings the remainder of the arbitrary design into harmony with the love affair and the extent to which the presence of supernatural forces is significant in the representation of the non-tragic universe. Here it appears that the limitations placed upon characterization and the introduction of so many times and places are part of a purposeful use of the techniques of romantic narrative, and that it is precisely by the use of such techniques that Shakespeare creates for the stage a universe in which the gods may freely intervene in the affairs of men. The pervading religious imagery, the mystical nature of Posthumus' conversion, the peculiar position in the design of the two divine visions, and the insistent sense of death and resurrection transform what might have been a purely romantic triumph over tragedy into a specifically religious triumph as well. The design of Cymbeline thus becomes meaningful and unity can be said to exist in the play only to the degree that all its words and actions demand to be related to a transcendental view of reality.

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THE LUMINOUS WEB: A CRITICAL SURVEY OF THE POETRY OF MRS. SAROJINI NAIDU

(Publication No. 5629)

M. George Thomas, Ph.D.
University of Pennsylvania, 1953

Supervisor: E. C. Bolles

The popularity of Sarojini Naidu stems from two different sources: literary and political. Nature made her a poet, but her country's political aspirations, and her own patriotic fervour had forced on her the role of a soldier, in favour of which she relinquished her natural calling as a poet. In both the fields she had made a distinctive contribution, and had earned, in the history of both, an abiding place. The purpose of this study, however, is mainly a critical evaluation of her poetic work; and whatever biographical details are furnished here are intended, primarily, to provide a background against which her work may be better understood and appraised.

Sarojini, the daughter of Aghorenath Chattopadhyaya and Varadasundari Devi, was born in Hyderabad, India, on February 13, 1879. Here she grew up and received her early education till she went to England in 1895. After three years of study there, interrupted by ill-health, she returned home in 1898 and, to the scandal of her community, married Dr. M. G. Naidu, a non-Brahmin. From 1895 till 1917,

she practised poetry, fitfully, and was also active in the social and cultural movements of the country. By 1914, she had drifted, almost completely, from poetry to politics and served the nation, for the rest of her life, in various capacities including the Presidency of the Indian National Congress. And upon the attainment of independence, she was made governor of the United Provinces on August 15, 1947, which office she held until her death on March 3, 1949.

Her poetical career began at the age of eleven. But if we exclude her juvenilia, her entire work comprises three slender volumes: The Golden Threshold, 1905, The Bird of Time, 1912, and The Broken Wing, 1917. These works reveal a fine poetic sensibility, the growth and development of her poetic faculties and outlook, the influence of the English Romantics and Victorians, and of some great poets of her own country. However, the promise of a greater future in her poetic ambition was cut short when, after 1917, she completely abandoned poetry for politics.

In her themes and interpretation of India, she presents a rich, colourful, representative, though sometimes inadequate, pageant of the land: its variegated scenes, its teeming population, its racial and communal mosaic, its religious and cultural patterns, its history, mythology and legends, its political hopes and aspirations. Both in the choice of themes and their presentation, she reveals a sensitive perception, a naturalness of expression, and a closeness to the soil, which make her verse wholly autochthonous.

More interesting than this is the technique and texture of her verse and its delicate workmanship, which reveals a passion for beauty, a love of colour and of finely turned epithets and images. Also, noteworthy is her attempt to fuse with thought, emotion and imagination, a felicity in expression, an aptness in imagery, and a melody that matches all — in short, an attempt at "a rhythmical and musical creation of beauty." Her talent is essentially lyrical.

Her work bears the hall-mark of the oriental poets' preoccupation with the mysteries of life, and asserts the certainity of the higher Power and fuller state of life hereafter. And her philosophy, on the whole, is optimistic and positive. In her attempt to write verse in an alien medium, without, at the same time, being alien or unatural in sentiments, expression or attitudes, she has helped to create an autochthonous verse, which has opened a new vista of poetical self-expression for the Indo-Anglian poets.

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W. B. YEAT'S LITERARY USE OF CERTAIN ANGLO-IRISH AUGUSTANS

(Publication No. 5501)

Donald Thornhill Torchiana, Ph.D.
State University of Iowa, 1953

The purpose of this dissertation is to describe W. B. Yeats' use of Swift, Berkeley, Burke, and Goldsmith in his essays, poems, and one play, The Words Upon the Window-Pane. The resulting study is in the end a literary examination of each of the four men in relation to Yeats, in relation to each other, and finally in relation to the concept and symbol, Unity of Being.

The first section consists of four chapters, each dealing with a separate Anglo-Irish figure. In each chapter the procedure is the same. First, the factual truth in Yeats' prose concept of any figure, say Swift, is determined. Next, the role of the individual in the aesthetic surface of Yeats' essays is shown. Then the minor use to which Yeats puts one of these men in his prose fiction is discussed. Following this step, the attempt is made to distinguish between the poetic image of Swift, Berkeley, Burke, or Goldsmith and the earlier prose concept. Finally, in the case of Swift, a further literary use is discerned in Yeats' dramatic re-enactment of moments in Swift's life in the play The Words Upon the Window-Pane.

The second section investigates Swift at the hands of modern writers contemporary with Yeats. It is felt that Swift's literary use by these writers is in general also representative of Berkeley, Burke, and Goldsmith as imaginative counters in the world of modern literature. For the sake of comparing Yeats with his contemporaries, Swift was selected to represent a general usage since the perennial fascination of his life and writings would imply a corresponding volume of literary comment and treatment. Accordingly, one finds Yeats rarely so narrow, usually more controlled, and frequently more daring in his essays than the modern casual essayist on Swift. In prose fiction, one finds Yeats neither in the company of the ambitious novelists of Swift nor as experimental in his minor effects as, say, James Joyce. Last, the poetry of Yeats is discovered to be at once more highly wrought than most poetry employing Swift; yet in its formality and almost hieratic style, it does not tend to the massive translucency of Eliot nor does it undertake the reorganization of language or primary thought found in Finnegan's Wake. The structure of Yeats' drama modelled his most romantic clothes, but succeeded by poised tautness of proportions where other structure collapsed under the weight of disproportions.

The last section treats the four-fold image of Swift, Berkeley, Burke, and Goldsmith as they are used together. The image is shown to help represent Yeats' concept and symbol of Unity of Being, and the process of reinforcement from genre to genre is outlined. At the end, the use of these four men in the slender segment of Yeats' total work observed is said to testify to certain norms. These norms are a continuity of method, a romantic quality in prose,

poetry, and drama, and an abiding sense of reality inherent in Yeats' attempt to reconcile literary, political, and philosophical values in his use of four Anglo-Irish Augustans.

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LOPE DE VEGA AND THE ELIZABETHAN AND JACOBEAN DRAMA

(Publication No. 5763)

Oscar Milton Villarejo, Ph.D.
Columbia University, 1953

This dissertation develops the following points in order to show the relations between the theater of Lope de Vega (1562-1635) and the drama of England during the Renaissance:

1. The printer of Lope de Vega's El peregrino en su patria (Sevilla, Clemente Hidalgo, 1604) failed to copy Leaf 9º (99 titles of plays) from an unknown edition of the novel when he reproduced the list of the titles of 349 plays which Lope inserted in the prologue of the former edition. It is therefore evident that Lope's Peregrino list of 1604 should contain the titles of 448 plays of his composition rather than the 219 credited to him for that year by bibliographers who depend upon the Barcelona, 1604, volume of the Peregrino for their information.

2. Lope's Las grandezas de Alejandro (limits, 1582-1583) treats of the same subject matter of Alexander the Great, Campaspe, and the painter Apelles which John Lyly dramatized in his Campaspe (limits, 1580-1584). The Spanish play probably preceded the English play by one or two years.

3. The first act of Lope's La tragedia del rey Sebastián y bautismo del Príncipe de Marruecos was written originally as a one-act auto sacramental between 1585-1593. Like George Peele's Battle of Alcazar (limits, 1588-1589) the Spanish play dramatizes the death of King Sebastian of Portugal in Africa at the hands of the Moorish horsemen of Muley Maluco at the battle of Al Kasr al Kebir (August 4, 1578).

4. Peele's David and Bethsabe (limits, 1581-1594) resembles Lope's Las lágrimas de David, which was enacted as an auto sacramental at the Corpus Christi festival at Seville in 1582 under the title La muerte de Urías y casamiento de David con Bethsabe. Lope commemorates the latter play through his "Soneto 314. A la muerte de Urías y lágrimas de Betsabé" (Biblioteca de autores españoles, XXXVIII, 395) and he commemorates his La tragedia del ray Don Sebastián (1585-1593) by his "Soneto XV. A la batalla de Africa," as found in his La hermosura de Angélica (composed before September, 1583, but retouched for printing prior to 1602). Lope records a play about Absalom in his Angélica by means of his "Soneto CIV. De Absalon," but the play seems to be lost, unless Los cabellos de Absalón (Samuel 2: 11-20) now attributed to Calderón os Lope's. If the latter is so, the underplot of Absalom and his flowing hair in Peele's David and Bethsabe could have been derived, like the main plot of the English play, from an early auto sacramental by Lope de Vega.

5. Lope rather than Luis Veléz de Guevara composed La nueva ira de Dios y Gran Tamorlán de Persia, as shown by the title page of that play in the British Museum copy of Parte 33 de varios autores (Valencia, Claudio Macé, 1642). This piece, which, like Christopher Marlowe's Tamburlaine the Great, Part I, is ultimately referable to Pero Mexía's Silva de varia lección (Seville, 1540) and to Petrus Perondinus's Magni Tamerlanis Scytharum Imperatoris Vita (1553), was enacted for the first time at the Corpus Christi festival at Seville in May, 1583, as proved by numerous allusions to the play and the festival in Lope's La hermosura de Angélica. As stated before, Lope composed the original verses of the Angélica in 1583 — that is, while he was serving as a volunteer with the squadron of the Marquis de Santa Cruz on the Spanish naval expedition to the Azores (June 23rd to Sept. 15th, 1583). Marlowe might have seen Lope's El Gran Tamorlán of 1583 in print when the former composed his Tamburlaine the Great, Part I (limits, 1587-1588). Marlowe's Edward II (1591-1593) and Lope's La gran comedia del Rey por trueque (date unknown) also show resemblances in dramatic characters and theme.

6. Lope's handwriting appears in large portions of the surviving Ms. comedia Marco Antonio y Cleopatra (signed at Madrid on Sept. 7, 1582 by the completely unidentified author "J. Diego López de Castro"). Lope alludes to his play Marco Antonio y Cleopatra in Acts II and V of his dialogued novel La Dorotea (published 1632 but written between 1585-1588) and he speaks again of his tragedy of Mark Antony and Cleopatra in his Arcadia (Madrid, 1598) and once more of his "Cleopatra which today the world praises" in his Fiestas de Denia (Valencia, 1599). Since Rennert shows that the four-act comedia Marco Antonio y Cleopatra of 1582 was recast into a new play after that date and since it can be shown that Francisco de Rojas Zorrilla wrote a thinly disguised refundición of Lope's "lost" play of Mark Antony and Cleopatra of circa 1598, it follows that the three-act drama now attributed to Rojas under the title Los áspides de Cleopatra (1640) is a revision by that author of Lope de Vega's original play Marco Antonio y Cleopatra (1582) after Lope revised the former to compose a new play in three acts circa 1598. But Los áspides de Cleopatra by Rojas which is referable to Plutarch's "Life of Antony" dramatizes the same portions of Plutarch's "Life of Antony" which Shakespeare is said to have employed in composing Antony and Cleopatra between 1598-1608. A printed play entitled Marco Antonio y Cleopatra was in existence during the latter years of the Spanish Golden Age, inasmuch as Calderón (died 1681) specifically cited its title when he repudiated a large assortment of plays of the old Spanish theater (many by Lope de Vega) which were being sold to the public under the name of Pedro Calderón de la Barca.

7. Lope's Castelvines y Monteses (Bandello, II, 9) was written between February and May, 1588. Shakespeare's Romeo and Juliet (Bandello, II, 9) was composed between 1591-1597. Klein is probably correct in stating that Shakespeare saw Lope's Castelvines y Monteses in its printed form before he composed his Romeo and Juliet. (See Albert R. Frey, "William Shakespeare and Alleged Spanish Prototypes," Papers of the New York Shakespeare Society. No 3. New York, 1886).

8. Edward M. Wilson, Cervantes professor of Spanish at the University of London links Shakespeare's Othello with the tragedies of honor of the Spanish Golden Age. Item No. 8100 in Paz y Melia's catalogue of comedias of the old Spanish theater (Catálogo, II, 35) is a manuscript play in a late nineteenth-century hand entitled Otelo, o sea El Moro de Venecia. This three-act play in verse is an identical text in Spanish of the Italian libretto of Rossini's opera Otello; ossia, Il Moro di Venezia, composed by the Marquis Berio in 1816. Both dramatic pieces are transcriptions in Spanish and Italian respectively of selected portions of an unidentified three-act continental play which was in existence in 1816, a play distinctly different from Shakespeare's five-act play Othello of date 1603-1604, although ultimately referable to Giraldi Cinthio's Hecatommithi as in the English play. The Spanish comedia Otelo (No. 8100), the Italian libretto Otello: ossia, Il Moro di Venezia, and Shakespeare's Othello must be directly related to each other, since all three plays feature dramatic characters named Othello, Rodrigo, Iago, and Emilia — a series of proper names not mentioned in their common source in Novela 7, Dec. III., of Giraldi Cinthio's Hecatommithi (Venice, 1562). The text of the unknown play from which the Spanish, Italian, and English plays about Othello and Desdemona seem to have been derived could have been a three-act Spanish comedia by Lope de Vega, inasmuch as the Marquis Berio knew Spanish. Furthermore, Lope employed Giraldi Cinthio's Hecatommithi for the composition of such plays as El piadoso veneciano (before 1604) and El esclavo de Venecia (date unknown). It is also possible that prior to 1604 Lope employed the only known Spanish translation of the Hecatommithi for his dramatized versions of these Italian tales, because this volume was published at Toledo in 1590 and Lope was writing plays at Toledo or at nearby Alba de Tormes between 1590-1595.

9. Fletcher's The Loyal Subject, Fletcher and Massinger's The Prophetess, Massinger's The Roman Actor, and Shirley's The Doubtful Heir and The Brothers are directly referable to well-known plays of Lope de Vega.

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LANGUAGE AND LITERATURE, LINGUISTICS

A TENTATIVE PORTUGUESE DICTIONARY OF DATED FIRST OCCURRENCES TO THE YEAR 1350

(Publication No. 5579)

George Beaver Clemens, Ph.D.
University of Pennsylvania, 1949

Supervisor: Edwin B. Williams

This study is a tentative dictionary of dated first occurrences of Portuguese words in documents and literary works before the year 1350. Material used for the work includes all the dated documents of the period in the Portugaliae Monumenta Historica, the Archivo (Arquivo) Historico Portuguez, the Revista Lusitana, the Boletim de Filologia, the Bausteine zur romanischen Philologie, João Pedro Ribeiro's Dissertações Chronologicas e Criticas, and G. Pereira's Documentos historicos da cidade de Evora, and all of the poems in Carolina Michaëlis de Vasconcellos' Cancioneiro da Ajuda, Henry Lang's Das Liederbuch des Königs Denis von Portugal, and the Royal Spanish Academy's edition of the Cantigas de Santa Maria.

All glosses have a grammatical designation, an English translation, a date, and a documentation, the latter being an abbreviation of the title of the book where the word is found, with the page or line reference.

Previous works in which an effort was made to date old Portuguese vocabulary are A. A. Cortesão's Subsídios para um Diccionário Completo (Històrico-Etymológico) da Língua Portugueza, Norman P. Sacks' The Latinity of Dated Documents in the Portuguese Territory, and Viterbo's Elucidario das palavras termos, e frases que em Portugal antigamente se usaram e que hoje regularmente se ignoram. Lexicographical items listed in these works antedating the present author's own findings have been included with due credit to the earlier investigators.

It is hoped that the compilation will serve as the first contribution to the task of writing a complete historical Portuguese dictionary. The work has been conceived as a dictionary, and not as a list of spelling variants. All words are glossed according to the modern Portuguese spelling set forth in the Pequeno Vocabulário Ortográfico da Língua Portuguêsa, published by the Academia Brasileira de Letras in Rio de Janeiro in 1943, with the approval of the Academia das Ciências of Lisbon.

The standardization of the spelling was a necessary procedure for making the work a dictionary. A simple word like filho can be spelled in a variety of ways in Old Portuguese: filho, fillo, filio, filo; ffilho, ffillo, ffilio, ffilo. Still it remains one lexicographical unit, and not eight.

The introduction to the work gives an outline of the methof of standardizing Old Portuguese variations. For example, double vowels and double consonants are reduced, and stressed final -ão, -õ, and -ã have been standardized as -ão. Certain

variations in spelling were thought to constitute separate lexicographical items, and were glossed as such. Apaul and paul, for example, are given as separate words.

Regardless of the form of words in the documents studied, certain standard principles of lexicographical procedure were followed in the glossing. Nouns are glossed in the singular, and adjectives in the masculine singular, accompanied by the feminine if the latter is irregular. Regular verbs are glossed in the infinitive. Irregular verb forms are listed in tables under the infinitive, with cross reference only for those forms which diverge from the modern ones. Idioms are included under the words which were thought to be the most important in the expression. Transitive and intransitive meanings are given separately. The dictionary does not include proper names.

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MATLAPA AND CLASSICAL NAHUATL: WITH COMPARATIVE NOTES ON THE TWO DIALECTS

(Publication No. 5858)

Kenneth Croft, Ph.D.
Indiana University, 1953

Nahautl, a Uto-Aztecan language, is still spoken by nearly a million people in Mexico. The language is taught academically in institutions of higher learning in Mexico City; it is considered an important ethnological tool by anthropologists. Nahuatl was first reduced to writing in the 16th century. A large amount of early historical and ethnological material concerning Mexico was written in the language — the cultural data recorded by Sahagún, chronicles, annals, poetry, etc. The term "Classical" Nahuatl used in this dissertation refers to dialects spoken at the time of the conquest of Mexico, but now extinct, with only written records remaining. The term "Modern" Nahuatl refers to dialects still spoken or recently extinct.

The corpus of Classical material used for analysis was taken from two 16th century Nahuatl grammars and one dictionary. The dialect of Modern Nahuatl selected for analysis was that of Matlapa, San Luis Potosí; first-hand field data for this dialect were gathered by the writer.

The segmental phonemes of Classical Nahuatl are i, e, o, a, p, t, k^w, k, c, λ, č, s, l, š, h, m, n, w, and y. Stress occurs automatically on the penultimate syllable of most words; in a few instances where this rule does not apply, stress is marked. The segmental phonemes of Matlapa Nahuatl include those noted above plus u, b, d, g, f, x, ñ, r, and r·. The additional phonemes have resulted from unassimilated parts of Spanish loanwords in the language. The automatic pattern of stress, falling on the penult, has been interrupted by the introduction of loanwords, and stress is marked on words which deviate from the pattern. Because of the word-medial contrast between the sequence oral vowel plus nasal conconant (V+N) and nasalized vowels (NV), the morphophonemic symbol n̲ has been adopted to indicate morpheme-final N, which occurs before another consonant, and NV, which occurs before an oral vowel, a semivowel, and in phrase final.

Certain areas of the transcription of 16th century Nahuatl appear suspicious, but the corpus provided is inadequate to ascertain conclusively whether these areas are valid. For example, /h/ apparently lacks representation at various points in the transcription; vowel length, although phonemic in all probability, was unmarked.

Morpheme alternations in Nahuatl are of two types: those that occur throughout the language, irrespective of the distribution class of the morphemes concerned, and those incidental to morphemes of a particular distribution class. For the first type of alternations, the conditions under which they are found are noted, without listing the alternants themselves. For the second type, the alternants of affixes are listed by distribution classes (century and decade classes). Bases with alternate forms are also listed and described.

The phonemic shapes of numerous Matlapa and Classical morphemes are identical; other morphemes shared by the two dialects are of similar composition. The Classical counterparts of Matlapa n̲ are m and n. Matlapa h and Classical w are often found in corresponding positions.

Nahuatl words are grouped into three categories: nouns, verbs, and particles. Words of each category contain a nucleus, designated as a stem: noun stem; verb stems — intransitive, transitive, benefactive; particle stem. The composition of stems is described and the distributions of the various classes of morphemes are listed and exemplified.

The bases and stems of Matlapa and Classical Nahuatl are treated in substantially the same fashion; structural similarities make such a treatment possible and, for comparative purposes, desirable. The affixes call for different groupings of distribution classes.

Samplings of Matlapa and Classical Nahuatl are provided by one text from each dialect.

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L'ART DE LA PHRASE NARRATIVE ET DESCRIPTIVE DE BERNARDIN DE SAINT-PIERRE DANS PAUL ET VIRGINIE

(Publication No. 5496)

Janine Alice Rossard, Ph.D.
State University of Iowa, 1953

The purpose of this study is to determine the criteria by which one can derive an appreciation of Bernardin de Saint-Pierre's art of the sentence in the narration and description of Paul et Virginie.

According to the three main divisions of the method followed for the analysis of both types of sentence: syntax, word order, rhythm, and within the limits of the problems selected for study in each division (Syntax: verbs, characteristic devices such as comparisons, metaphors, parallelisms, antitheses, negations, plural forms, superlatives; Word order: elision and inversion of the verb, disjunction; Rhythm: apex of the sentence, sectional organization of the sentences), it appears that the author's sentence style remains basically the same, the narrative sentence showing the same traits as the sentences of descriptive passages, narrative and descriptive elements being often joined in the same sentence.

The shortening of the sentences through the diminution of the quantity of relative clauses replaced by participial clauses, propounds the adherence to the purist school of the 18th century. However, Bernardin de Saint-Pierre still uses a great number of relative clauses, because he generally favors grammatical articulations, the nature of which is undifferentiated enough to allow for variation of levels of the several elements of the sentence and for the suggestion of spatial or psychic reactions. Vividness is often conferred to the outline of the sentences by means of coordinating conjunctions (et and mais), especially when they are separated from the clause by a comma and by the disjunction of some terms, which are thus projected from their neutral background. Several instances, especially in the case of relative clauses, show that Bernardin de Saint-Pierre's approach to his subject matter consists of an aesthetic process of valorization than of logical considerations.

This is the reason why the analysis of the rhythmic organization of the sentences is most important for the full comprehension of Bernardin de Saint-Pierre's art. It should be mentioned at this point that the conclusions reached in respect to rhythm are mainly due to a theoretical introduction and to a practical analysis of the sentence in Paul et Virginie conducted by Professor Aspel in the seminar "Literary Style and Methodology" (1951-2-3).

As in the syntax and word order, the principle of variation within a harmonious continuity forms the basis of the sentence movement as well as of the cycles or groups of rhythmic sentences. The general character of unity springs from the use of an apodosis as a rule longer than the protasis, from the attenuated apex in the melodic movement of the sentence, due to parenthetic elements before and after it, and also from the average length of the sections, which generally varies from 8 to 15 syllables. Such a continuity is, however, interrupted at intervals, the apodosis becoming very short, or the protasis being a very brief section in the sentence. In the majority of cases, either the sentence or the apodosis have a ternary organization (three sections). Expressive or impressive movements recur in sequences of sentences or at intervals in the text; nevertheless, it is necessary to stress that such imitative rhythms do not dominate in the sentences but are regulated by the general effect of harmony.

The present dissertation furnishes grounds on which to base a more pertinent appreciation of Bernardin de Saint-Pierre's artistry and general aesthetics than has been attempted so far. It is hoped that it may contribute to a better understanding of Bernardin de Saint-Pierre's position in the history of literature as well as to the elucidation of the problems of style in general. As far as it is known, no critical study of Bernardin de Saint-Pierre's art of the sentence has been made up to date; if one recalls that Gustave Lanson called Bernardin de Saint-Pierre "le creatéur de le phrase pittoresque" (L'Art de la Prose, ch. 14), he mentioned him mainly from the point of view of semantics without explaining what connection the "pittoresque" had with the sentence itself, or to what aesthetics this "picturesque sentence" belonged. One realizes that there was an obvious gap left in his survey of French literary prose. It is hoped that the present dissertation has contributed, at least partially, to filling this gap.

It is believed also that the present study might be of some practical use, especially to teachers and students of French Literature because of some detailed observations concerning the oral interpretation of Bernardin de Saint-Pierre's text.

Microfilm copy of complete manuscript of 314 pages, $3.93. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1505.

OLD JUDAEO-SPANISH EVIDENCE OF OLD SPANISH PRONUNCIATION

(Publication No. 5558)

Irving Spiegel, Ph.D.
University of Minnesota, 1952

Spanish historical phonology, which studies the changes in pronunciation from the period of the introduction of Latin into the Iberian Peninsula until the present, is based almost exclusively on the written word. It is possible to make a study of the phonemes of Spanish today with no reference to the past, but a description of the sounds of Old Spanish must be based on deductions and inferences from the historical development of the sounds of Old Spanish. The changes that occur in "spelling" over a relatively long period of time and in a considerable number of texts must be properly interpreted to reveal the development of the sounds of the language.

Therefore, scholars who have purposed to determine the sounds of Old Spanish have based their conclusions on phonetic and etymological studies of Old Spanish texts, and more recently, have added comparative studies, i.e., phonetic and etymological development in other Romance languages.

In addition to the examination of Old Spanish texts some scholars have investigated the comments on pronunciation made by grammarians in Spain and elsewhere in the fifteenth, sixteenth and seventeenth centuries, the testimony of Spanish texts written in Arabic and Hebrew characters, the evidence of Spanish sounds revealed in the transliterations of Arabic words and American Indian words in Latin characters, and the pronunciation of Modern Judaeo-Spanish.

It is the purpose of this study to examine Old Judaeo-Spanish in order to determine how well it serves as corroborative evidence of the pronunciation of Old Spanish. The Judaeo-Spanish MSS. and printed books examined here date from the twelfth to the sixteenth centuries. To interpret this material it is necessary to present first a description of the system of transliteration employed by the Spanish Jews in the Old Spanish period and then furnish a detailed account of the pronunciation of Old Spanish based on what information we possess of the pronunciation of Hebrew in the late Middle Ages and our knowledge of the Romance vernaculars spoken by the Sephardim in Spain.

After essaying a description of the sounds of Hebrew in the Old Spanish period based on the traditional pronunciation, the modern studies of Hebrew phonology, and the transliteration of Arabic into Hebrew characters, this study treats all the sounds of Old Spanish on the basis of Old Judaeo-Spanish testimony including those accepted by Hispanists and those which need more clarification. If Old Judaeo-Spanish evidence corroborates the generally accepted sounds one may assume that it will have validity in the clarification of those sounds still in doubt.

THE SOUNDS OF OLD SPANISH REVEALED IN OLD JUDAEO-SPANISH CONSONANTS

1. Bilabials

a) Old Spanish p = פ [p]

b) b = ב [b]: b-v-u = בֿ [v or β]

c) m = מ [m]

2. Labiodentals

a) f = פֿ [f]

b) v = בֿ and ו [v]

3. Interdentals

a) d = ד [d] or ḏ [ḍ]

b) -d or -th = ד-ḏ [ḍ] or ת [θ]

4. Dentals

a) Old Spanish t = ט [t]

b) d = ד [d]

c) ce-ci-ç = ס [ç]

5. Alveolars

a) s-ss = שׂ [s]

b) z = ז [z]

c) n = נ [n]

d) l = ל [l]

e) r-rr = ר [r]

6. Palatals

a) ch = ג̇ [ĉ]

b) g-j = ג̇ [ĝ when initial, ǯ]

c) x = שׁ [x̌ š]

d) ñ = ני or ניי [n̲]

e) ll = לי or ליי [l̲]

f) y = י or יי [y]

7. Postpalatals

a) c-qu = ק [k]

b) g = ג [g]

8. Laryngeals

a) h = ה [h]

VOWELS

There is no controversy concerning the vowels of Old Spanish. Nevertheless, the Old Judaeo-Spanish vowel system is most conclusive evidence, especially in the words pointed with the Masoretic vowel diacritics which leave no doubt of the vocalization.

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A STUDY ON THE PUBLICATIONS OF THE GOVERNMENT OF INDIA, WITH SPECIAL REFERENCE TO SERIAL PUBLICATIONS

(Publication No. 5732)

Champaklal Pranshanker Shukla, Ph.D.
University of Michigan, 1953

It is the purpose of this investigation to select the important publications of a few branches of the Government of India (Central Government) and describe them against the background of the department which issued them; a brief history of the department concerned is traced and its administrative relations and functions are described.

The dissertation begins with a chapter outlining the present Government of India, describing its main divisions and their functions.

This is followed by a chapter on the publications dealing with the administration in general. It deals with four groups: (a) those official works which give an introduction to the country and its people such as the Gazetteers; (b) administration reports; (c) the Gazette of India; (d) publications giving information on administrative personnel.

The next chapter deals with parliamentary publications; a brief history indicating the various stages of evolution of the legislature, from the Legislative Council in 1833 to the Parliament in 1950, is narrated and the chief parliamentary publications issued during this time are described.

The fourth chapter is concerned with the laws and acts of the Indian Republic. In addition to giving a brief history of codification in India, the chapter deals with the law publications which form the following four groups: (a) the Constitution; (b) the statutes of the British Parliament; (c) unrepealed central acts; (d) statutory rules and orders.

The fifth chapter deals with the judicial publications. It discusses the constitution of the present judicial system and describes the serial publications dealing with the decisions of the Privy Council, the Federal Court, the Supreme Court, and the High Courts.

The next chapter is on the publications relating to the census and finance of the Government. A history of census activities including the procedure for the census enumerations are followed by the details of the statistics available in census publications; the financial publications are treated in three groups: those dealing with (1) finances (2) budget and (3) accounts and audit.

Chapter seven is devoted to the statistical publications. It traces the history of various efforts by the Government to create a central statistical organization and describes the publications of the two main agencies in the field, the Economic Advisor to the Government of India and the Director General of Commercial Intelligence and Statistics.

The following chapter deals with the catalogues of publications and the map publication work of the Government. It gives the main catalogues dealing with the Indian official publications and the activity of the Survey of India and the Geological Survey of India. The various series of maps issued by these departments are described with the necessary details.

The last chapter is concerned with the Publication Branch of the Government of India. It traces the history of the Publication Branch and its present activity. A note on the problems of acquisition and organization of Indian official publications concludes the work.

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BAYES AND MINIMAX PROCEDURES IN SAMPLING FROM FINITE POPULATIONS

(Publication No. 5777)

Om Prakash Aggarwal, Ph.D.
Stanford University, 1953

The classical estimates and sampling procedures have been studied from the modern viewpoint of decision theory. Most of the estimates have been shown to be minimax when the loss function in estimating the mean or total (except in the case of the estimation of proportion defective in a lot of finite size) is taken to be the squared error in the estimation of the mean or total. Attention is confined to only fixed size sampling procedures.

The problem of sampling from a finite population has been considered in the following way. The finite population is regarded as the outcome of a fixed sample size experiment performed by nature or some conscious being, using some probability distribution unknown to the statistician. The loss function, however, does not depend upon the form of the probability distribution but only upon the outcome of this large experiment. Use has been made of the fact that under these circumstances, if the statistician is permitted to choose a sample of fixed size n, the optimum strategy for him is to choose it by the method of simple random sampling.

In the case of the estimation of the proportion defective, say p, in a lot of finite size, N, it has been shown that the usual procedure of estimating p by the proportion found defective in a sample drawn at random from the lot is in fact a minimax procedure, while the least favorable distribution of nature is a uniform discrete distribution over all the N+1 possible values of p. The loss function in this case is assumed to be

$$L(p,f) = (f-p)^2/p(1-p)$$

and the constant risk obtained is $\frac{1}{n}\frac{N-n}{N-1}$, where n is the size of the sample.

In the other cases of estimation considered, the least favorable distributions of nature do not exist. The minimax estimates are obtained by first obtaining a sequence of Bayes estimates and the corresponding Bayes risks, and then obtaining an estimate which has its risk equal to the limiting value of the Bayes risks. The Bayes and minimax estimates and sampling procedures have been obtained both for the infinite and the finite populations.

In the case of stratified sampling, the loss function is taken as

$$L(u,f) = (f=u)^2 + \sum_{i=1}^{k} c_i n_i$$

where f is the estimate of u, the population total, c_i, n_i are cost per sampling unit and the number of sampling units chosen from the ith stratum, while k is the number of strata. The minimax procedure has been found to choose n_i sampling units at random from the ith stratum, where

$$n_i = \text{integer nearest to } \sqrt{\frac{N_i^2 \sigma_i^2}{c_i} + \frac{1}{4}}$$

and to employ the usual estimate $f = \sum_{i=1}^{k} N_i \bar{x}_i$ where N_i is the size of the ith stratum and $\bar{x}_i$ the sample mean from that stratum. The minimax risk is found to be

$$\sum_{i=1}^{k} \left[N_i^2 \left(\frac{1}{n_i} - \frac{1}{N_i}\right) \sigma_i^2 + c_i n_i \right].$$

In the case of cluster sampling, which is considered as a special case of two stage sampling, where sampling at the second stage consists of observing the entire cluster, the minimax risk, apart from sampling costs, is shown to be

$$R = \frac{\sigma^2}{nM} \left[1 = (M - 1)\, \rho \right]$$

where σ^2 is the variance of population sampled, M is the size of each cluster, and ρ the intra-class correlation.

In the consideration of the ratio method of estimation, it is shown that if a population can be classified on the basis of the values of an auxiliary characteristic y, and if the unknown mean and the known variance of x's for a given y are each proportional to y, then a minimax procedure is to choose a random sample of size n_i from each class, n_i being proportional to N_i, the total number of units in the ith class, and to employ the classical ratio method of estimation, viz.,

$$f = \frac{\text{sum of x's in the sample}}{\text{sum of y's in the sample}} \times \text{sum of y's in the population.}$$

The constant of proportionality for choosing n_i is given by

$$n_i = \sqrt{\frac{\beta T_y}{C}}$$

where β is the known constant of proportionality for the variances of x for given y, T_y is the sum of all y values in the entire finite population and C is the cost

of complete enumeration. Here also the loss function is taken to be the usual squared difference plus a constant cost per observation.

Finally it is shown that for any bivariate distribution with v, the mean and σ_y^2, the variance of y known, ρ, the correlation coefficient, and σ_x^2, the variance of x known, the minimax procedure for estimating u, the unknown mean of x is to choose n pairs (x,y) of observations, where

$$n = \text{integer nearest to } \sqrt{\frac{\sigma_x^2 (1 - \rho^2)}{c}} + \frac{1}{4}$$

and to employ the usual regression estimate

$$\bar{x} - \frac{\rho \sigma_x}{\sigma_y} (\bar{y} - v) .$$

Here c is the cost of sampling per pair of observations. The same result holds good in sampling from a finite population also. The loss function in this case has been taken as

$$L(u,f) = (f-u)^2 + cn .$$

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CONTINUITY AND HOMEOMORPHISM GROUPS

(Publication No. 5584)

Robert Ellis, Ph.D.
University of Pennsylvania, 1953

Supervisor: W. H. Gottschalk

The situation considered is the following. Let X be a separated uniform space and let Φ be a group of homeomorphisms of X onto X. Then under what conditions is Φ equicontinuous? This problem seems much too general to attack with present methods and consequently the spaces considered must be restricted in some way. If this is done some solutions may be given. In order to examine the problem more closely let us make the following definitions. Let $\pi : X \times \Phi \to X$ be the map such that $(x,\varphi)\pi = x\varphi$ ($x \in X$, $\varphi \in \Phi$) and let for each $x \in X$ $\pi_x : \Phi \to x\Phi$ be the map such that $\varphi \pi_x = (x,\varphi)\pi = x\varphi$. We say that: (i) X is a minimal orbit - closure provided that $\overline{x\Phi} = X$ for all $x \in X$, and (ii) The group Φ is rigid provided that if $x, y \in X$ with $x \neq y$ and $z \in X$, then there exists a neighborhood U of z such that if $\varphi \in \Phi$ with $x\varphi \in U$ then $y\varphi \notin U$. Intuitively this means that if $x \neq y$ then they cannot get arbitrarily close under the action of Φ. The notion of minimal orbit - closure was first employed by G. D. Birkhoff and that of rigidity by D. Hilbert.

The main technique employed for the investigation of the above problem is the following. The group Φ is provided with various topologies (mainly the point open) and conditions on X are sought which make the map π continuous. It turns out that under rather simple additional assumptions that if π is continuous when Φ is provided with the point open topology that Φ is equicontinuous.

Along these lines the following result is obtained. Let X be a locally compact T_2 - space, let Φ be rigid, let $\mathcal{T}$ be a first countable topology on Φ which makes multiplication in Φ unilaterally continuous and such that π is also unilaterally continuous, and let $x \in X$ such that $x\Phi = X$. Then is continuous on $x\Phi \times \Phi$. This theorem can be applied to groups in general. Let G be a first countable locally compact T_2 - space with a group structure such that multiplication in G is unilaterally continuous, then multiplication in G is bilaterally continuous. If moreover G is separable, it may be concluded that G is a topological group. These results replace the conditions of complete metric by first countable local compactness in an analogous result of D. Montgomery's.

To return to the main problem let the further assumption that each π_x ($x \in X$) is one - to - one be made. Then the map $\pi_x^{-1} \pi_y$ ($x,y \in X$) maps one orbit into another and might well be called an orbit transfer. (It might be remarked in passing that if the orbit transfers are continuous then Φ is rigid.) Using the results on the continuity of π the following main theorem is proved. Let X be a first countable compact minimal orbit - closure such that the orbit transfers are continuous. Then Φ is equicontinuous.

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ON THE METHOD OF SUCCESSIVE APPROXIMATIONS

(Publication No. 5793)

Joel Franklin, Ph.D.
Stanford University, 1953

This dissertation consists of four chapters. In the introductory chapter the basic notions of the principle of the method of successive approximations, of the norm of a matrix, and of enveloping series are given. Then a generalized Lipschitz condition is described. In this Lipschitz condition it is assumed that a certain operator $\mathcal{J}$ is given which transforms matrices X(z), which are defined and continuous for z on a certain path Γ in the complex plane, into matrices Y(z) of the same type. Then we suppose that for all pairs of matrices $X_1(z)$, $X_2(z)$ lying in a certain class, Ω, an inequality of the form

$$\left|\mathcal{J}X_2(z) - \mathcal{J}X_1(z)\right| \leq \sigma \left|X_2(z) - X_1(z)\right| + \tau(z) + \varphi(z) \int_{z_0}^{z} \left|X_2(t) - X_1(t)\right| d\psi(t)$$

is satisfied. Here the symbol $|X|$ represents the scalar norm of a matrix X; the point z_0 is the initial point of Γ; the constant σ is $\geqq 0$; the functions $\tau(z)$, $\varphi(z)$ are continuous and $\geqq 0$ on Γ; and the function $\psi(z)$ is continuous and steadily increasing on Γ. The path Γ may be infinite, and the conditions of continuity are allowed to fail at the initial point z_0. After these basic notions are defined, most of the results obtained in the dissertation are listed.

At the root of every development in the second chapter is the fundamental theorem on functional equations of the form

$$W(z) = \mathcal{J}W(z),$$

where the operator $\mathcal{J}$ satisfies the generalized Lipschitz condition. Following this theorem there are very general theorems of uniqueness, of existence, and of enveloping series. Then there is a direct, general application to systems of ordinary differential equations. Next there is an application to ordinary linear differential equations which uses the concept of the "related" differential equation. The results of the preceding sections are then used to derive the existence-and-uniqueness theorems of Picard-Lindelöf, Peano, and Nagumo. There follows an extension of the theorem of Nagumo. Next there are two sections on systems of ordinary functional differential equations. These systems are divided into two categories, those which, like differential equations, lead to initial-value problems and those which, like differential-difference equations, lead to initial-function problems. For each category theorems of uniqueness, of existence, and of enveloping series are given. Next the fundamental theorem is applied to the problem of the existence and uniqueness of an analytic solution at a singular point of a system of ordinary differential equations. A concise and general theorem is given. Examples are given which show that the result obtained is quite sharp. Then this theorem is used to derive some classical results of Briot and Bouquet and of Fuchs.

In the first section of the third chapter a very sharp uniqueness theorem is presented which is applicable to many systems of ordinary differential equations in which the generalized Lipschitz condition is not satisfied. In the second section a theorem is given which shows that the solutions of many systems of ordinary differential equations in which the generalized Lipschitz condition is not satisfied, can be constructed by means of the method of successive approximations.

The application of the method of successive approximations to differential equations involves multiple integrals which are, as a rule, extremely difficult to calculate. In the fourth chapter it is shown that a very wide class of second-order linear differential equations related to the differential equation

$$s'' + p(z)s = 0,$$

where $p(z)$ is a linear function of z, forms an exception to this rule. This result is then used to extend a result of F. Tricomi on the asymptotic behavior of the nth Laguerre polynomial $L_n^{(\alpha)}(x)$ in the neighborhood of the point $x = 4n$.

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NUMERICAL METHODS IN DIGITAL REAL TIME SIMULATION

(Publication No. 5596)

Harry Joshua Gray, Jr., Ph.D.
University of Pennsylvania, 1953

Supervisor: Morris Rubinoff

The author deals with the stability and asymptotic behavior of the computed solutions of ordinary differential equations such as would occur in real-time simulation problems. Qualitative conditions for satisfactory simulation and methods of analysing the differential equations in order to see whether or not they satisfy the conditions are given. The method of analysis is to consider the combination of the quadrature formula and the differential equations to be finite difference equations satisfied by the computed solutions. "Stability" charts are derived and are given for a few quadrature methods including the Modified Euler Method. The charts are shown to be rigorously applicable to linear constant-parameter systems and to be heuristically applicable to the varying-parameter and non-linear systems dealt with in some real-time simulation problems. Well-known types of instability occurring in the course of the numerical solution of differential equations are shown to have one common source.

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ON APPROXIMATIONS TO MONOTONE MAPPINGS ON TWO-DIMENSIONAL MANIFOLDS

(Publication No. 5680)

John Gilbert Hocking, Ph.D.
University of Michigan, 1953

The goal of this study of monotone mappings is to extend several known results from the case of a compact two-dimensional manifold to the non-compact case and to consider in particular the complications involved in discussing the 1-monotone images of a non-compact two-dimensional manifold with boundary. The results obtained are applied to some problems concerning differentiable manifolds and harmonic surfaces.

This paper separates naturally into two parts. In Part I preliminary topological results are collected.

After a brief introductory section, Section 2 of Part I defines, after G. T. Whyburn, various mappings of locally compact spaces and mentions a few properties of these mappings. In Section 3 of Part I a modification (Theorem 3.3) of the well-known imbedding theorem for n-dimensional spaces is established for a certain class of geometric complexes. Section 4 of Part I is devoted to a discussion of the relation between n-monotone mappings and S-n-regular convergence in a locally compact space. Generalizations of two results of Whyburn are proved in this section.

In Part II of this paper the results of Part I are applied to two-dimensional manifolds. After a brief preliminary remark (Section 5), Section 6 combines known results to yield a generalization of an approximation theorem of J. W. T. Youngs concerning monotone mappings of a compact two-dimensional manifold onto itself. Section 7 contains a generalization of a result of Roberts and Steenrod and of V. Martin on the 1-monotone image of a two-dimensional manifold. This theorem is then combined either with well-known results or with those of Section 6 to yield several more approximation theorems concerning a type of mapping defined to be monotone-1. In the final Section 8 a few remarks are made which suggest applications of the foregoing material to a question about differentiable manifolds and harmonic surfaces. Several unsolved problems are raised.

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CONTRIBUTIONS TO SAMPLING INSPECTION

(Publication No. 5802)

Gerald J. Lieberman, Ph.D.
Stanford University, 1953

Sampling inspection can be divided into two categories, namely, continuous inspection and lot-by-lot inspection. In the former, items are manufactured in a continuous stream, and current inspection results are used to determine whether sampling inspection or screening inspection is to be used for the next articles to be inspected. In the latter, items are formed into lots and each lot is accepted or rejected on the basis of a sample drawn from the lot. In "Contributions to Sampling Inspection" some aspects of both of the above types of inspection are considered.

Chapter I deals with a continuous sampling plan published by H. F. Dodge in 1943 in the Annals of Mathematical Statistics. Dodge showed that his procedure guarantees an Average Outgoing Quality Limit with the assumption that the process is in a state of statistical control. It is proved in this chapter that the Dodge procedure, without the assumption of control, guarantees an Average Outgoing Quality Limit, although different from that specified by Dodge.

Lot-by-lot sampling inspection can be divided into two categories, sampling inspection by attributes and sampling inspection by variables. Chapter II deals with the problem of finding a multistation inspection scheme, using sampling inspection by attributes, whose Operating Characteristic (OC) curve (the probabilities of being accepted at all stations) matches the OC curve of a given (one station) sampling plan. A set of sampling plans which are applied to individual characteristics of items in a given lot at several stations during the production process is called a multistation inspection scheme. The procedure suggested is briefly as follows: The percentage defective is estimated by counting the total number of defects at all the stations, and the lot is rejected if this estimate is too large. The OC curve obtained by using this procedure is a function of the individual percentage of defects at each station, and consequently, given only an over-all percentage defective, an OC band is obtained rather than a single curve. However, the band is narrow and for practical purposes, can be characterized by the OC curve obtained when all the defects are concentrated at one station.

In Chapter III, the problem of estimating the percentage of volume within specified limits of the multivariate normal distribution is considered. Estimates are obtained when the random variables are known to be independent, and for the general case. These estimates are based upon the minimal set of sufficient statistics, and it is shown that they are unbiased and have uniformly minimum variance. In the course of deriving the above results, it is shown that the minimal set of sufficient statistics for the multivariate normal distribution are complete. These estimates are then applied to a similar problem as that considered in Chapter II, except that sampling inspection is by variables. A serious restriction in the use of sampling inspection by variables has been that only one characteristic can be considered at a time. This chapter presents sampling inspection procedures for items containing multiple characteristics. The procedure is briefly as follows: The percentage defective (the percentage of items lying outside the specification limits) is estimated, and the lot is accepted if this estimate is small. The OC curve for this procedure depends upon the distribution of the defectives among the characteristics, and consequently, given only an over-all percentage defective, an OC band is obtained. However, it is shown that this band is narrow, and for practical purposes can be characterized by the OC curve obtained when all the defectives are concentrated in one characteristic.

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SOME RESULTS IN THE THEORY OF MULTIPLY HOMOGENEOUS POLYNOMIALS

(Publication No. 5490)

George W. Peglar, Ph.D.
State University of Iowa, 1953

Let k be a field and let $R = k[X_0^1, \ldots, X_{n_1}^1; \ldots; X_0^s, \ldots, X_{n_s}^s] = k[X^1; \ldots; X^s]$ be a ring of polynomials in s sets of indeterminates. A polynomial f in R is homogeneous of degree r_i in the set X^i if all of its terms are of the same total degree r_i in $X_0^i, X_1^i, \ldots, X_{n_i}^i$. A polynomial $f_{(r)}$ is called a form of degrees $r = (r_1, \ldots, r_s)$ if it is homogeneous of degree r_i in X^i, $i = 1, \ldots, s$. Every polynomial f can be written as the sum of forms $f_{(r)}$, called the homogeneous components of f. An ideal A in R is called a multiply homogeneous ideal (H-ideal) if $f \in A$ implies $f_{(r)} \in A$ for all homogeneous components $f_{(r)}$ of f. An H-ideal A is defined to be irrelevant of type (i) if Rad $A \supseteq (X_0^i, \ldots, X_{n_i}^i)$. An H-ideal A is said to be of first species (i) if A is completely free of irrelevant components and if for some linear form $L_i = L_i(X^i)$ in the single set of indeterminates X^i, the ideal $A + RL_i$ is free of irrelevant components of type (i). If A is of first species (1), (2), ..., (s), then A is said to be of first species.

The principal result achieved is the following theorem. If A is an H-ideal of first species and if $F = F(X)$ is a form which is not contained in any prime of A then $A + RF$ is completely free of irrelevant components.

An algebraic variety W in multiply projective space is defined to be of first species if I(W), the H-ideal determined by W, is of first species. If is proved that if W is a cartesian product of ordinary algebraic varieties $W_1, W_2, \ldots, W_s$, then W is of first species if and only if W_i is of first species, $i = 1, \ldots, s$. Let S(W) be the Segré representative in an ordinary projective space of a variety W in multiply projective space. The concluding result is: If W is of first species then S(W) is of first species.

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BROWNIAN MOTION AND THE GREEN'S FUNCTION - THE PLANE CASE

(Publication No. 5618)

Anne Elizabeth Scheerer, Ph.D.
University of Pennsylvania, 1953

Supervisor: Bernard Epstein

The problem considered in this thesis is one arising in a paper of M. Kac entitled Some Applications of the Theory of Brownian Motion to Potential Theory. There Kac proved by probabilistic methods the existence of a generalized Green's function with pole at infinity, of the exterior of a bounded three-dimensional set. We have considered the problem of modifying Kac's method in order to prove the existence of the exterior Green's function of a plane set.

We first briefly sketch Kac's method. Let $\vec{y}$ be any point in (three-dimensional) space and consider the Brownian process beginning from the point $\vec{y}$ at time $t = 0$. Directly from the definition of Wiener Measure it is easily shown that the expected value of the time spent by a curve in a (bounded) region Ω is given by:

$$E(T) = \frac{1}{2\pi} \int_\Omega \frac{1}{|\vec{r} - \vec{y}|} \, d\vec{r}. \tag{1}$$

It is important to note that the integral is convergent whether $\vec{y}$ lies inside or outside Ω. Similarly the higher moments, i.e., the expected values of the powers of the time spent in Ω, can be written:

$$E(T^n) = \frac{n!}{(2\pi)^n} \int_\Omega \cdots \int_\Omega \frac{1}{|\vec{r_1} - \vec{y}|} \frac{1}{|\vec{r_2} - \vec{r_1}|} \cdots \frac{1}{|\vec{r_n} - \vec{r_{n-1}}|} \, d\vec{r_n} \, d\vec{r_{n-1}} \cdots d\vec{r_1}. \tag{2}$$

Now expanding the symmetric kernel $\frac{1}{|\vec{r} - \vec{s}|}$ (which is in L^2) in terms of its eigenfunctions and eigenvalues we can immediately express $E(T^n)/n!$ in terms of these eigenfunctions and eigenvalues. Multiplying by $(-u)^n$, where u is a positive real constant, and summing from $n = 0$ to $n = \infty$ one obtains an expansion for the function

$$h(\vec{y}; u) = E(e^{-ut}). \tag{3}$$

From this expansion one finds without difficulty that $h(\vec{y}; u)$ satisfies an integral equation:

$$h(\vec{y}; u) = 1 - \frac{u}{2\pi} \int_\Omega \frac{1}{|\vec{r} - \vec{y}|} h(\vec{r}; u) \, d\vec{r}. \tag{4}$$

Using the integral equation in combination with certain inequalities which the probabilistic interpretation of $h(\vec{y}; u)$ makes obvious, it is easily shown that

$$\lim_{u \to \infty} h(\vec{y}; u) = G(\vec{y}) \tag{5}$$

exists and is, for $\vec{y}$ outside Ω, the exterior Green's function of Ω.

Now, while these methods of Kac are extended without too much difficulty to higher dimensions, they cannot be applied directly in the plane because there the analogue of (1) diverges. By introducing a parameter ϵ into our work we render all integrals convergent, but in doing this the probabilistic interpretation of the different variables is lost. This loss of probabilistic interpretation is the chief cause of

difficulty in the two-dimensional case, for here all the properties of our functions require strictly analytical proofs. Also, it must be recalled that in the plane the Green's function becomes logarithmically infinite at infinity, in contrast to approaching unity as in three dimensions.

We define a function $h^*(\vec{y};u,\epsilon)$ similar to $h(\vec{y};u)$ and satisfying an integral equation analogous to (4). This equation is

$$(6)\quad h^*(\vec{y};u,\epsilon) = 1 - \frac{u}{2\pi}\int_e k(\epsilon|\vec{r}-\vec{y}|)\, h^*(\vec{r};u,\epsilon)\, d\vec{r},$$

where $K(z)$ is πi times the Hankel function $H_0^1(iz)$.

We can deduce analytically from (6) the same inequalities governing $h^*(\vec{y};u,\epsilon)$ which Kac obtained for $h(\vec{y};u)$ from probabilistic considerations. We find for the two-dimensional Green's function the following relationship, similar to, but more complicated than (5):

$$(7)\quad \lim_{\epsilon\to 0}\ \lim_{u\to\infty}\ \ln\frac{1}{\epsilon}\, h^*(\vec{y};u,\epsilon) = G(\vec{y}),\ \vec{y} \notin \Omega .$$

The expression (7) is suggested by explicit solution of the equation (6) for the case when Ω is a circle. For more general Ω a major difficulty arose in establishing the convergence of the outer limiting process in (7), but this obstacle was overcome by an appeal to Ascoli's theorem on equicontinuous collections of functions and the uniqueness of the Green's function.

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THE BANACH ALGEBRA OF CONTINUOUS MAPPINGS FROM A COMPACT HAUSDORFF SPACE TO A BANACH ALGEBRA

(Publication No. 5737)

William Kay Smith, Ph.D.
University of Michigan, 1953

A study is made of the Banach algebra B^X of the set of all continuous mappings from a compact Hausdorff space X to a Banach algebra B. Here B is assumed to have identity e and to be commutative. The scalars may be either real or complex; in the former case it is assumed that b^2+e has an inverse for each $b \in B$; in the latter it is assumed that $b \in B$ implies $b^* \in B$, where $b^*(M) = \overline{b(M)}$ for each maximal ideal M in B. It is shown that the maximal ideal space η of B^X is homeomorphic to $X\cdot\mathfrak{M}$, where $\mathfrak{M}$ is the maximal ideal space of B. Thus each ideal $M \in \mathfrak{M}$ determines a subset $\eta(M)$ of η homeomorphic to X. This fact is exploited to obtain a theorem stating that X and Y are homeomorphic if an isomorphism exists between B^X and B^Y which also provides an isomorphism between the constant mappings in B^X and those in B^Y; moreover, this condition is necessary.

Next, further properties of B^X are investigated in the case that B is semi-simple and a set of necessary and sufficient conditions is given describing when, for given algebras A and B, there is a compact space X such that A is equivalent to B^X. The conditions are based on the sets $\eta(M)$ mentioned above, although the points of X are bounded linear multiplicative transformations from A to a subalgebra B′ equivalent to B. Throughout the numerical-valued functions $b(M)$, $M \in \mathfrak{M}$ and $f(N)$, $f \in B^X$, $N \in \eta$, are used extensively.

If B is not semi-simple a characterization based on these methods does not seem possible. It is shown however that if B has radical P then the radical Q of B^X is exactly P^X. Also if B is a direct sum of B/P and P then B^X/Q is equivalent to $(B/P)^X$ and B^X is a direct sum of B^X/Q and Q.

Consideration is given to the relation between the maximal ideals of a Banach algebra and the T-sets Myers has defined in a Banach space. Roughly speaking, the former are related to "minimum value" whereas the latter are related to "maximum value". A method of enlarging each maximal ideal to a set more closely related to the T-set is given, although it is pointed out that since the ideals depend only upon the algebraic structure of the algebra whereas the definition of T-set involves the norm of the space the analogy probably cannot be pushed too far.

The final section specializes B to be a regular algebra as studied by Šilov, i.e. one such that Gelfand's topology for $\mathfrak{M}$ and the Stone intersection topology mentioned by Gelfand and Šilov lead to homeomorphic spaces. It is shown that B^X is regular if and only if B is regular.

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THE COMPRESSIBLE FLOW ABOUT A POINTED BODY OF REVOLUTION OF CURVED PROFILE WITH ATTACHED SHOCK WAVE

(Publication No. 5740)

Guilford Lawson Spencer, II, Ph.D.
University of Michigan, 1953

The main problem considered is the constructive solution of the equations for the steady flow between the surface of a pointed body of revolution immersed in a uniform flow without yaw, and its attached shock wave, in a plane through the axis of revolution. The determination of the shock wave is an integral part of this problem.

In the plane through the axis of revolution, polar coordinates (r,θ) are introduced; pole at the point of the body, and initial ray coincident with the body axis. Consideration of the (r,θ) coordinates as Cartesian coordinates has the effect of separating the shock and body curves, and of removing the singularity caused by the difference between the

velocity on the back of the shock and the velocity on the body at the tip. The boundary conditions and equations for $r = 0$ lead to two point boundary value problems for ordinary equations. The solutions of these problems yield functions of θ which can be used as coefficients in power series in r, which express the flow variables as functions of r and θ. These solutions also yield a power series in r for the shock curve. If these power series converge, it is proved that they represent a solution.

The major results obtained are:

(A) a new proof of the existence of solutions of the Taylor-Maccoll equations for conical flow and associated inequalities.

(B) a procedure for the calculation of a non-yaw flow about "cone-like" bodies. (A body is "cone-like" if its profile curve in polar coordinates has all derivatives of odd order with respect to r equal to zero for $r = 0$.)

(C) a procedure for the calculation of shock-body curvature ratios at the nose.

(D) a method of solution of singular boundary value problems for quasi-linear hyperbolic systems of partial differential equations.

The solutions of the two point boundary value problems are obtained in terms of auxiliary functions which depend only on the Mach number of the undisturbed flow and the body nose angle. For practical use, these functions could be tabulated. The determination of the coefficients of the series could then be made fairly easily.

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PROJECTIVE RELATIONS IN MODULAR LATTICES

(Publication No. 5747)

Gerald Luther Thompson, Ph.D.
University of Michigan, 1953

The purpose of this dissertation is to develop tools for the study of the lattice $\mathfrak{L}(\mathfrak{A})$ of invariant subspaces of a faithful representation of an algebra $\mathfrak{A}$. $\mathfrak{L}(\mathfrak{A})$ is known to be modular, projectively closed and is complemented if and only if $\mathfrak{A}$ is semi-simple. When $\mathfrak{A}$ is semi-simple $\mathfrak{L}(\mathfrak{A})$ is essentially a direct product of projective geometries and this case has been extensively studied. Not much is known about the "geometry" $\mathfrak{L}(\mathfrak{A})$ of a non semi-simple algebra $\mathfrak{A}$ and the beginning of such a study is the object of the present investigation.

A central problem of lattice theory is to determine to what extent modular lattices are geometrical objects. A very classical result is that in a complemented modular lattice of dimension four or greater one can introduce coordinates with respect to a skew field. The usual way of phrasing the above question is: can a modular lattice be imbedded isometrically in a complemented modular lattice? The answer to this question has been shown to be negative by Dilworth and Hall [Annals of Math. 45 (1944) 450-456] for lattices of dimension four or greater.

The latter question is not considered in the present work, but instead the following question proposed by R. M Thrall [a. Canad. J. of Math. IV (1952) 227-239]. Let η be a complemented modular lattice and $\mathfrak{L}$ a sub-lattice. $\mathfrak{L}$ is said to have the relative imbedding property if and only if there exists a complemented modular sub-lattice $\mathfrak{M}$ of η such that $\mathfrak{L} \subset \mathfrak{M} \subset \eta$ and $\mathfrak{L}$ is isometrically imbedded in $\mathfrak{M}$.

The thesis is divided into three Chapters.

In Chapter I the work of R. M. Thrall [b. Proc. Amer. Math. Soc. 2 (1951) 146-152] on projective quotients in a modular lattice is extended to higher dimensional quotients. A new concept, that of a root, is introduced and characterized as a finite lattice.

Chapter II takes up the study of projectively closed modular lattices which were defined by R. M. Thrall [a]. A concept called projective closure in the small is briefly studied and shown to be inadequate for most purposes. If $\mathfrak{W}$ is an n-dimensional vector space over a field κ let η be the lattice of all subspaces of $\mathfrak{W}$. If $\mathfrak{L}$ is a sub-lattice of η then by a choice of basis in $\mathfrak{W}$ a convenient way of representing subspaces W of $\mathfrak{L}$ by means of a matrix Σ (W) is obtained. The lattice operations of join, meet and projective combination of spaces in $\mathfrak{L}$ are then translated into operations on the matrices Σ (W). Similar problems on the solution of linear equations are treated.

Chapter III is concerned with the relative imbedding problem of R. M. Thrall [a. pp. 231]. An example of a projectively closed sub-lattice which does not possess the relative imbedding property is given.

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I. POLYNOMIAL APPROXIMATIONS TO SOLUTIONS OF VARIATIONAL PROBLEMS IN THE COMPLEX DOMAIN, II. ON THE MEAN CONVERGENCE OF THE MAPPING FUNCTIONS IN CONFORMAL MAPPING OF REGIONS BOUNDED BY "NEARLY SMOOTH" CURVES

(Publication No. 5568)

Chih-yi Wang, Ph.D.
University of Minnesota, 1953

Let C be a closed analytic Jordan curve which bounds a region D. Let $\mathfrak{F}$ be the class of analytic functions f(z) in D such that $f(z_0) = 0$, $f'(z_0) = 1$, $z_0 \in D$ and $f'(z) \in H(2,C)$. It is well known that there exists $\varphi(z) \in \mathfrak{F}$ which minimizes

$$\left\{\frac{1}{L}\int_C |\varphi'(z)|^2 \, |dz|\right\}^{1/2} = \|\varphi'\|$$

where L is the arc length of C. In this paper we approximate $\varphi(z)$ by the polynomial $Q_n(z) \in \mathfrak{F}$ of degree $\leq n$ which minimizes $\|Q_n'\|$ and get an estimate for this approximation. We make use of the fact that Hilbert space is a uniformly convex Banach space,

and a rate of convergence is obtained. By means of this rate we use Szegö polynomials and Fejér-Riesz theorem to obtain the estimate

$$1\ \varphi(z) - Q_n(z) \leqq M\rho^n$$

where $0 < \rho < 1$, ρ depends on the analyticity of the curve C and M is some constant.

Furthermore the following problem is solved. Let $L_j(f)$, $j = 1,2,\ldots,m$ be the given linear functionals in $H(2,C)$, let $f \in \bar{E} \subset H(2,C)$ such that $L_j(f) = 0$ for all j and let $f_0 \in H(2,C) - \bar{E}$ such that not all $L_j(f_0)$ vanish. We find $g \in \bar{E}$ such that $\| f_0 - g \|$ = minimum. Then let P_n be the polynomial of degree $\leqq n$ in E such that $L_j(Pn) = 0$ for all j and $\| f_0 - P_n \|$ = minimum. We show that $P_n \rightarrow g$ and obtain an estimate of the rate of convergence.

II. ON THE MEAN CONVERGENCE OF THE MAPPING FUNCTIONS IN CONFORMAL MAPPING OF REGIONS BOUNDED BY "NEARLY SMOOTH" CURVES

The object of this paper is to generalize certain results concerning the mapping function of regions bounded by contours with continuously turning tangent to domains whose boundaries satisfy weaker conditions. Let C be a closed Jordan curve which contains a circle of radius $d > 0$ in its interior. We shall call C "nearly smooth" if for a fixed $p \geqq 1$ there exists an ω, $0 < \omega < d$ such that for any four points w_1, w_1', w_2, w_2' of C in counterclockwise order with $|w_1 - w_2| < \omega$, $|w_1' - w_2'| < \omega$, $|w_1 - w_1'| < \omega$ (for suitable choice of argument)

$$|\arg(w_2' - w_1') - \arg(w_2 - w_1)| < \frac{\pi}{4p}.$$

The principal result proved here is the following Theorem II. Let $w = f_m(z)$, $m = 0,1,2,\ldots$ map the unit circle $|z| < 1$ conformally onto regions R_m each of which is bounded by a closed Jordan curve C_m, respectively; suppose that all R_m contain the circle $|w| \leqq d$, where d is independent of m, and that $f_m(0) = 0$, $f_m'(0) > 0$. Suppose furthermore that the C_m satisfy the following conditions:

(a) For a fixed $p \geqq 1$, C_m is "nearly smooth", whereby the number ω is the same for all $m = 0,1,2,\ldots$.

(b) All C_m, $m = 0,1,2,\ldots$ are contained in a bounded region R.

(c) There exists a constant k such that if P_1 and P_2 are two points of C_m and Δs is the length of the shorter arc between them then

$$\Delta s / \overline{P_1P_2} \leqq k \quad \text{for all } C_m.$$

(d) C_m has the parametric representation $w_m(t) = u_m(t) + iv_m(t)$, $m = 0,1,2,\ldots$, $0 \leqq t \leqq T$, and C_m converges to C_0 in such a manner that $w_m(t)$ converges uniformly to $w_0(t)$ as $m \rightarrow \infty$ for $0 \leqq t \leqq T$.

Then

(i) The mapping functions $f_m(z)$ converge uniformly to $f_0(z)$ as $m \rightarrow \infty$ for $|z| \leqq 1$, and

(ii) For every ϵ, $< 0 < \epsilon$, $p - \epsilon > 0$

$$\int_0^{2\pi} |f_m'(e^{i\epsilon}) - f_0'(e^{i\epsilon})|\, p^{-\epsilon}\, d\epsilon \rightarrow 0 \text{ as } m \rightarrow \infty.$$

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FINITE PLANE PROJECTIVE GEOMETRIES

(Publication No. 5518)

James Robert Wesson, Ph.D.
Vanderbilt University, 1953

Supervisor: E. Baylis Shanks

A finite plane projective geometry (henceforth called a geometry) with n points on a line is easily constructed provided n-1 is a power of a prime. It is not known if other geometries exist. There is only one geometry with n points on a line if n = 3, 4, 5, or 6, and for each of these geometries the theorem of Desargues is valid. There are no geometries for n = 7. For n = 10 there are two geometries, one desarguesian and the other non-desarguesian. It is not known if there exist more than one geometry for the cases n = 8 or n = 9.

Some elementary properties of geometries follow easily from the postulates, and others are obtained when the geometry is constructed by using an algebraic system. A straightforward method of constructing a geometry by naming the points on each line leads to the conclusion that the existence of geometries is equivalent to the existence of a ternary system (called an H-system) with a finite number of elements 0, 1, a, b, ... such that:

H1. aOb = Oab = b, 1aO = a10 = a.

H2. abx = c has a unique solution x.

H3. For $a \neq c$, the equations axy = b, cxy = d have a unique solution x,y.

The third postulate may be replaced by the following:

H3′: For $a \neq c$, the equation xab = xcd has a unique solution x.

The ternary operation abc of an H-system should not be assumed to be the result of two binary operations, but an analogy can be drawn between an H-system and a double binary system. An A-order is defined so as to be analogous to the additive order of an element in a field. Similarly, "associative" and "distributive" laws are defined.

Define for each element x in an H-system $x_0 = 0$ and $x_i = 1x_{i-1}x$ for i = 1, 2, ..., and let the A-order of x be the first $i \neq 0$ for which $x_i = 0$. Then each element will have an A-order. The "associative" law is 1(1xy)z = 1x(1yz) and the "distributive" laws are $ax_i0 = (ax0)_i$ and $x_ia0 = (xa0)_i$.

For the H-system the following theorems are proved:

Theorem 1. Any one of the following three conditions is equivalent to each of the other two.

$$\text{(a) } 1x_ix_j = x_{i+j}\ ,\quad \text{(b) } 1(1x_ix_j)x_k = 1x_i(1x_jx_k)\ ,$$

$$\text{(c) } 1(1x_ix_j)x = 1x_i(1x_jx)\ .$$

(Operations among subscripts are modulo m, the A-order of the element).

Theorem 2. If one of the conditions in Theorem 1 is satisfied, then it follows that $(x_i)j = x_{ij}$.

Theorem 3. If either "distributive" law holds, then all non-zero elements have equal A-orders.

Theorem 4. In order that there exist a geometry with r+1 points on a line, where r is not a prime-power, it is necessary that the corresponding H-system be either non-"associative" or non-"distributive."

Theorem 5. In order that an H-system with a prime number of elements define a field under the binary operations defined by a+b = 1ab, ab = ab0, it is necessary that the H=system be "associative" and "distributive."

It is possible to coordinatize some geometries with finite double binary systems. The postulates for three such systems are given below. The systems are called A(s), A(VW), and $A(p^n)$.

A(s): (1) There is an element o such that
$a + 0 = 0 + a = a$.
(2) Each of the following has a unique solution x:
$x + a = b$,
$a + x = b$,
$ax = b \quad (a \neq 0)$,
$xa = b \quad (a \neq 0)$.
(3) $Oa = aO = 0$.
(4) For $a \neq c$, the equation $xa + b = xc + d$ has a unique solution x.

A(VW): (1) The set forms an additive group with identity 0.
(2) a0 - 0a - 0.
(3) For $a \neq 0$, ax = b and ya = b have solutions.
(4) a(b = c) = ab+ ac.

$A(p^n)$: (1) The set forms an additive group with identity 0.
(2) The elements other than 0 form a group under multiplication.
(3) $a(b + c) = ab + ac$.

Every $A(p^n)$ is an A(VW) and every A(VW) is an A(s). Also the following theorems are true:

Theorem 6. In an A(VW) all elements other than 0 have the same additive order.

Theorem 7. Any A(VW) with a multiplicative identity and a prime number of elements is an $A(p^n)$.

Theorem 8. There is only one algebra $A(p^n)$ with $p^n = 7$ or 8.

Theorem 9. Any algebra $A(p^n)$ where n - 1 is a field.

Theorem 10. There is only one $A(2^p)$ where p is a prime less than 11.

Any such binary system defines a geometry with points

$$(x,y,u),\quad (x,u,0),\quad (u,0,0)$$

where x,y are any elements of the algebra and (u,0) are distinct fixed elements of the same algebra. The lines have equations x = 0, y = 0, z = 0, x = ya, x = za, y = za, x = ya+zb, where a,b are not equal to 0. Then theorems 8, 9, 10 lead to theorems concerning geometries.

Finally, the connection between the H-system and the A(s) is investigated. For an H-system to form an A(s) under the operations given in Theorem 5, it is necessary and sufficient that for $a \neq c$ the equation 1(xa0)b = 1(xc0)d has a unique solution x. A sufficient condition is 1(ab0)c = abc.

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RINGS WITH GIVEN MODULE

(Publication No. 5912)

Robert Joel Wisner, Ph.D.
University of Washington, 1953

The problem considered in the thesis is that of finding binary (multiplicative) operations which may be imposed upon an (additive) abelian group G in order that G may become a ring.

A reduction of the problem consists of showing that F(G), the totality of elements of finite additive order in G is an ideal in every ring over G. This makes every ring over G an Everett extension of a ring over F(G) by a ring over I(G), the torsion-free group G - F(G). F(G) is a direct sum of p-primary abelian groups, and every ring over F(G) is a direct sum of rings over these p-primary components, again reducing the problem. Rings over p-primary groups are investigated, and some theorems involving height are obtained. The problem of the construction of rings with additive group which is the direct sum of cyclic groups is known, and so many of the theorems concern the reduction of the problem to this case. For example, if a p-primary group has no elements of infinite height, then all rings with the descending chain condition can be obtained by the consideration of rings over the direct sum of cyclic groups.

I(G) with rank one is discussed and some results obtained. The subcase of this with cyclic I(G) is completely discussed, and some theorems on possible rings and their properties are presented. The importance of a knowledge of the endomorphisms of F(G) becomes evident, and such endomorphisms are treated briefly.

Suggestions on further desirable knowledge for a complete solution of the problem are made throughout.

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MINERALOGY

DIRECTIONAL VARIATION OF RELATIVE GRINDING HARDNESS IN DIAMOND

(Publication No. 5660)

Reynolds McConnell Denning, Ph.D.
University of Michigan, 1953

The purpose of this research is to compare quantitatively the relative grinding hardness of single crystal diamonds for a series of planes in the three principal crystallographic zones. The only other published data (National Bureau of Standards) are five values distributed among the cube, dodecahedron and octahedron.

To measure the relative variation of grinding hardness in single diamond crystals, two devices were constructed. One, which is called a hardness comparator, permits the cutting of two crystals simultaneously. One crystal is oriented in an arbitrarily chosen unit hardness direction. The cutting rate of the second crystal is compared with the cutting rate of the reference crystal. To facilitate the measurements, a second apparatus was designed to prepare spherical surfaces of predetermined radii on the diamonds. This apparatus was used in connection with hardness variation measurements on the cube face. The remainder of the planes investigated were studied on pyramidally faceted stones, because of the very slow operation of the sphere grinder. Hardness curves were plotted, hardness against grinding azimuth, for a series of selected planes in the three principal zones.

It may be concluded that hardness of a crystal is a function not only of a line in space, but of the sense of direction along that line, and the crystallographic orientation of the facet on which the line lies. The diamond is a cubic substance, and because, for many properties, cubic crystals are isotropic, it is commonly said to be an isotropic substance. For the property of hardness, it is anisotropic. Because hardness is a function of both a line and the plane upon which that line lies, it is not susceptible to representation in three dimensions; therefore, it is not an ellipsoidal property.

The easiest cutting directions are those parallel to a crystallographic axis. The most difficult cutting directions studied are those in the [101] direction on the cube or dodecahedron faces. These faces have the optimum cutting direction parallel to a reference axis. More generally located planes have a relatively easy grinding direction the direction parallel to the orthogonal projection on the plane of the crystallographic axis most nearly parallel to the plane. This is in accord with previous work. The sense of the direction of easiest cutting depends upon the orientation of the plane being cut, unless hexoctahedral symmetry requires that both senses of direction be equal in hardness. No evidence of hextetrahedral symmetry was found in these crystals.

On diamonds it is impractical to generate spherical surfaces with radii of one to two millimeters by this method of grinding. The method used should readily produce spherical surfaces on other substances such as corundum or silicon carbide.

The surface markings of ground planes are dependent upon (1) twinning; (2) relative grinding hardness of surfaces being ground; (3) skeif surface condition.

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MUSIC

THE MASSES OF ANTOINE BRUMEL

(Publication No. 5760)

Lloyd Biggle, Jr., Ph.D.
University of Michigan, 1953

This is a study of the polyphonic Mass compositions of Antoine Brumel. The composer was born about the middle of the fifteenth century, possibly in the French village of Brunel. He held musical posts at the Cathedral of Notre Dame in Chartres, at the Cathedral of Laon, and at the Cathedral of Notre Dame in Paris. In 1505 he was in the service of the Italian nobleman Sigismund Cantelmus at Lyon, France. The Duke Alfonso I of Ferrara offered him the position of maestro di capella in that year, but no source reveals whether or not he accepted. Nothing is known of his life after 1505.

Sixteenth century writers esteemed Brumel highly, and rated him with the greatest composers of the period. Because little of his music has been available in modern editions, modern appreciation of Brumel has continued to be based to a considerable extent upon the opinions of these writers.

The aim of this dissertation is to provide a thorough and systematic study of Brumel's contribution to the most important musical form of the period, the polyphonic Mass. Microfilm was obtained of all

available Renaissance sources of Brumel's Masses, and they were transcribed into modern notation. Thirteen of the seventeen known Masses of Brumel were thus made available for study.

The procedure of the study is to take important aspects of Mass composition of the period and trace them through the thirteen Masses. In turn are considered: (1) the treatment of the cantus firmus by Mass types – the cyclic Mass, the parody Mass, the plainsong Mass and unclassified Masses; (2) the organization of the Mass by textual sectionalization; (3) factors of unity and contrast in the musical organization of Mass movements; (4) the treatment of text; and (5) Brumel's contrapuntal style.

Brumel is seen to be a composer of originality and frequently of consummate craftsmanship. His Masses possess their own intrinsic value as musical expression. In addition, they have historical significance in a stylistic complexity which represents the overlapping of the new and the old in a period of transition which is of considerable importance in music history. Of special interest are Brumel's parody Masses, which furnish important information with regard to the largely unexplored early history of that Mass type; the Mass Et ecce terraemotus, which employs twelve voices; the Mass Ut re mi fa sol la, which borrows the entire Guidonian System for its cantus firmus; the Requiem Mass, with its polyphonic setting of the "Dies irae"; and the Mass Dringhs, which offers an unusual harmonic style.

The stylistic complexity of the period is reflected in Brumel's Masses, not only in the variety of Mass types which he utilizes, but also in his contrapuntal style, which ranges from the ornamental Mass with the sustained cantus firmus to a freely imitative polyphonic structure. The music of Brumel may thus play an important role in the ultimate understanding and interpretation of the still largely unexplored music of the late fifteenth and early sixteenth centuries.

A representative selection from Brumel's Masses is provided in modern edition in Volume II of the dissertation, including the Masses Victime paschali and Dringhs, and excerpts from the Masses Ut re mi fa sol la, Berzerette sauoyene and Pro defunctis.

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THE ANTHEMS IN MUSICA DEO SACRA BY THOMAS TOMKINS

(Publication No. 5649)

Robert William Cavanaugh, Ed.D.
University of Michigan, 1953

Thomas Tomkins (ca. 1572-1656) was the last representative of the finest period in English musical history. He was a member of the Tudor-Jacobean group of composers who were the first to write music for the newly-formed Church of England. When England broke away from the Church of Rome in the sixteenth century, her composers suddenly were faced with the task of writing a complete body of music for the new Anglican liturgy. The English group met the challenge with marked success, incorporating some of the older style into the new. This dissertation is a study of anthems for the Anglican church, written by Tomkins, the last of the Tudor composers. Five Services and ninety-five anthems were published posthumously under the title Musica Deo Sacra.

Twenty anthems of the collection have been transcribed into modern notation in Volume II of the present study. They range from three-voiced unaccompanied penitential psalms, through multi-voiced full anthems for the entire choir, to verse anthems for one or more solo voices alternating with the full chorus and accompanied by instruments and organ. Printed originally in five part-books, for Medius, Contratenor, Tenor, Bassus, and Organ, the compositions are presented here in score, with reduced note-values, barring, and the clefs currently in use. A critical commentary covers printing mistakes in the original edition as well as differences between the printed edition and the few manuscript copies available. Both the printed edition and the manuscript were secured in microfilm from libraries in England.

Study of the music results in the realization that Tomkins was a true representative of the English school which developed a bolder style than the late sixteenth-century Roman school and approached the progressiveness of the early Italian baroque composers. Unusual melodic intervals, bold harmonies, intricate polychoral style, alternation of the old polyphonic and the new harmonic idioms, pungent dissonances, a growing trend from the old church modes to major and minor keys marked the music of the Tudor and Jacobean school. Its most outstanding feature, and one in which Tomkins excelled, was the vital linking of music to the text in a sympathetic manner.

Results of the study indicate that Tomkins was a worthy member of the group which gave England its "golden age" of music. A progressive composer who kept pace with developments in the areas of madrigal-writing, keyboard music, and instrumental music, he wrote moving religious music also. His style combines the best features of the great polyphonic period with the beginnings of the type of harmony that was to be fully developed in the eighteenth century. His frequent departure from the complex cross-rhythms of the polyphonic period to the regular arrangement of metrical groups marks him as progressing toward the late seventeenth-century metrical style, in contrast to many of his contemporaries, both insular and continental. Unduly neglected since his death, Tomkins deserves the recognition due to a worthy contemporary of William Byrd. For both practical and aesthetic reasons the consummate artistry of his music calls for similar recognition and hearing.

Microfilm copy of complete manuscript of 481 pages, $6.02. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1524.

CARL FRIEDRICH ABEL, SYMPHONIST: A BIOGRAPHICAL, STYLISTIC, AND BIBLIOGRAPHICAL STUDY

(Publication No. 5677)

Sanford Marion Helm, Ph.D.
University of Michigan, 1953

Carl Friedrich Abel (1723-87) spent the majority of his years in English music. He generously composed for the Bach-Abel concerts, which he directed in partnership with John Christian Bach. The series proved to be the mainstay of English musical life for nearly two decades (1764-82) and was influential in the establishment of permanent concert societies. Yet the historians of English music writing within the past century devote relatively few pages to the musical affairs surrounding the Bach-Abel concerts. Interested primarily in native English music, these writers exclude the roles of numerous foreigners in London, creating an inaccurate depiction of the actual musical situation. Abel's prominence in London musical life is further obscured because no detailed biography of him exists. Of the three parts in this study, Part I, Abel's Life and Time, presents the story of Abel and other musicians in London during the second half of the eighteenth century.

Abel is one of several composers who were overshadowed by Haydn and Mozart. As perspective is gained on the eighteenth century, men such as Abel again are recognized to have played an essential part in its activities. Abel's symphonies, his largest and most pretentious scores, offer the best general picture of his stylistic position.

In Part II, Abel's Symphonic Style, an attempt is made to secure a better general understanding of symphonic form and to place Abel's symphonies in relation to those of his contemporaries. Abel's symphonies date from the period when symphonic form and classical style were being formulated. Current reference-book explanations of musical form, on the other hand, are generally based on the more complex examples from Beethoven or Brahms. When applied to eighteenth-century music, the explanations are misleading and, on occasions, actually inaccurate while existing musical terminology to describe eighteenth-century forms is inadequate.

Eighteenth-century forms, and specifically sonata forms, are a product of stylistic procedure rather than stereotyped patterns. What constitutes a sonata scheme is an elementary investigation. That sonata form cannot be described solely on a basis of first-movement form is clear since fully evolved sonata forms appear in other movements as well. Each movement of a symphony has a specific character which cannot be established in terms of the form employed because the same form appears in various movements with a completely different result. Considerable evidence is found to justify a view of the eighteenth-century symphony, like opera, as a manifestation of demands for growth in a dramatic direction.

Abel's vocal composition was negligible, and thus a list of his instrumental works is representative of his total output. Apparently no thorough bibliographical study of his compositions has ever been made; Part III, Thematic Catalog of Abel's Instrumental Music, is devoted to this task. The resulting Catalog shows Abel's work to consist of at least 36 symphonies and 3 overtures for orchestra, 15 concertos and concerted pieces, 21 quartets and sonatas in four parts, 31 trio sonatas and trios, 26 sonatas for keyboard, 38 sonatas for viol da gamba and continuo, 17 sonatas for flute and continuo, and 42 miscellaneous pieces. Part III embraces an introduction, a catalog of works, a thematic index, and a synoptical index. Part III is bibliographically complete within itself and can be used independent of the other Parts.

Microfilm copy of complete manuscript of 396 pages, $4.95. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1525.

METHODOLOGY OF MUSIC THEORY: A TYPOLOGY OF THE METHODS OF INVESTIGATION, CLASSIFICATION, AND ARRANGEMENT OF MUSICAL MATERIALS

(Publication No. 5867)

George Hartvig Jacobson, Ph.D.
Indiana University, 1953

A general introduction containing the definition of terms and a statement of the problem constitute the preliminary discussion. The areas of music theory are reviewed and outlined in four levels of complexes of tone and time as a further contribution to the problem.

On the basis of a comprehensive research into the literature of music theory, an enumeration and discussion of over thirty methods of investigating, classifying and arranging musical materials are presented. This enumeration involves a discrimination of the single methods as well as the grouping of these single methods into four aggregate basic procedural and technical types. The discrimination of methods of music theory is determined by observing the means of measurement employed in the various sources of music theory. Each method is further identified by the listing of representative sources and by the areas of musical materials which each method investigates. The basic postulates of the methods are explained and examples of the data and classifications are recorded.

The aggregate types and the single constituent methods are as follows: 1. mathematical and physical methods consisting of general mathematics, arithmetic, geometry, logarithms, acoustics and electronics; 2. historical and social methods consisting of general history, music history, social science, comparative musicology, morals and religion; 3. semantic and analogic methods consisting of general philosophy, symbolic logic, aesthetics, language and literature, musical notation, color, painting and architecture; 4. physiological and psychological methods consisting of auditory theory, psychoacoustics,

experimental psychology, the motor response, psychology of music, Gestalt psychology, introspective psychology, Freudian psychology, music therapy, and psychological types.

Some of the problems reported are: the classification and differentiation of one method from another; the scope of each method; the scope of music theory as a whole; the delineation of nuance of measurement and scaling of the data of music theory; an examination of musical terminology from several points of view; and, the organization of source material with reference to method.

A summary and survey include a comparison of methods. The conclusions touch on the problem of "single best method" and the validity of certain methods. Recommendations are offered for further study. The 396-item bibliography is listed and grouped with reference to method (ix; 218 pp.; illus.).

Microfilm copy of complete manuscript of 227 pages, $2.84. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1526.

AMERICAN INDIAN MUSIC NORTH OF MEXICO: ITS STYLES AND AREAS

(Publication No. 5873)

Bruno Nettl, Ph.D.
Indiana University, 1953

This dissertation is an attempt to describe the various styles of American Indian music north of Mexico and to identify the geographic locations of these styles. The styles of this continent are grouped in six musical areas, each of which is relatively homogeneous. These areas are based on contrast of stylistic features; distributions of musical instruments do not, in general, coincide with them. Following are the chief characteristics of each of the areas.

The Eskimo-Northwest Coast area is characterized by rhythmic complexity, especially in the percussive accompaniment of the songs, recitative-like singing, and some polyphony of the drone type. The Great Basin area is characterized by small range, relaxed vocal technique, and a type of form in which each phrase is repeated. The California-Yuman area is marked by the presence of the Rise, a special type of ascending melodic movement. The Athabascan area is distinguished by arc-shaped melodic contours and simple rhythmic organization which makes use of only two durational values in most songs. The Plains-Pueblo area, which is the largest geographically, is characterized by very tense vocal technique and pulsation in the singing of long tones, cascading melodic contours, and rhythmic complexity. The Eastern area is marked by complex forms, antiphonal and responsorial techniques, and some initative polyphony.

The three centers of greatest musical complexity are the Northwest Coast, the Pueblos, and the Southeastern United States. These three centers are located in the three most populous musical areas and coincide roughly with the centers of greatest general cultural complexity and with considerable population density. In each musical area, however, there are both simple and complex styles. For example, the complex style of the Northwest Coast and the relatively simple style of the Eskimo are in the same musical area.

There is considerable correspondence between the musical areas and the culture areas of North America. Although these two sets of areas do not coincide specifically, their distributions share some traits. For example, in both music and general culture, there is greater diversity in the western part of the continent, greater homogeneity in the east. There is less correlation between the musical areas and language areas.

An attempt is made to reconstruct some of the history of North American Indian music. Although any such statements are highly tentative, it is possible to show that the continent was influenced primarily from two directions, the northern part of East Asia and Middle America, and that the musical styles of both individual tribes and areas have changed constantly and continue to do so under both Indian and European influences.

Microfilm copy of complete manuscript of 254 pages, $3.18. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1527.

A CENTURY OF METHODIST MUSIC: 1850 - 1950

(Publication No. 5492)

William C. Rice, Ph.D.
State University of Iowa, 1953

Relatively few studies have been made of practices and procedures in church music. The present investigation grew out of a need for three basic items of information about church music in general and Methodist church music in particular: first, how did church music arrive at its present state? second, what are the practices and procedures now in use? third, what needs to be done to raise standards of music and worship?

Original sources were consulted in an effort to trace the development of church music. Periodicals and hymn books provided the greatest amount of material. Books on church music could be used but rarely.

Information regarding present practices and philosophies was obtained through a questionnaire that was mailed to 3000 Methodist Churches in the United States, from which 1279 were returned. The material collected in this manner may be the most important contribution made by this study. However, these findings become more valuable when supported by facts concerning the development of church music.

The music of the Methodist Church prior to 1850

was limited to congregational singing of hymns. Choirs came into use only after overcoming much resistance. Until very recent times, the hymn (text) was always of prime importance; hymn-tune books were reluctantly accepted by the Methodist Episcopal Church, South, in 1859, by the North Church in 1879, and by the Methodist Protestants in 1884 as an outgrowth of an unusual period of interest in church music.

A second period of general interest in church music developed about 1895 and culminated in the hymnals of 1901 and 1905. By 1900 the quartet had become a regular feature of many church services, and choirs had attained a new place in Methodism. Because many choirs were improperly used during this period, an era of antichoir feeling developed shortly after the 1905 Hymnal was published.

The demand for adequate ministerial training in music and worship was occasionally heard prior to 1900, and has increased in intensity since then. The first two decades of the twentieth century contributed little to music and worship, except insofar as they were a time of preparation for the decades which followed.

A great period of growth in Methodist music started about 1920. The Methodist Hymnal of 1935 was a product of this era. The practices and philosophies of church music now attaining maturity had their origin in the twenties. While not yet adequate, the training offered in seminaries is far more complete in matters pertaining to music and worship than in past decades. Musicians, too, are increasingly inclined to blend themselves and their music into a harmonious whole with the church. The ministry of music is attaining the recognition that entitles it to be called a profession.

Methodist music and worship is moving toward a liturgical form similar to that used by the Episcopalian church. The great danger inherent in this trend is that the schism between rural and urban churches be made too wide to bridge. The emphasis being given to the development of a multiple choir plan in churches of all sizes may heal the breach. The availability of inexpensive organs — both pipe and electronic — is another factor that tends to bring the two philosophies close together.

Methodism must adopt a positive attitude toward the music of the church school, and at the same time activate a program of training that will affect congregations and ministers alike, particularly in small churches.

Microfilm copy of complete manuscript of 478 pages, $5.98. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1528.

THE OBOE: A COMPARISON STUDY OF SPECIFICATIONS WITH MUSICAL EFFECTIVENESS

(Publication No. 5723)

Myron Edward Russell, Ph.D.
University of Michigan, 1953

The purpose of this study is to determine, by measurement, playing test, and comparison, what relation various combinations of bore specifications, exterior body dimensions, and size and placement of the tone holes have on the musical effectiveness of the oboe. The importance of the relationship of the bore to musical quality arises from the fact that an almost unlimited number of starting diameters, rates of increase, deviations from a regular rate of increase, and maximum diameters are possible, with each new combination bringing about a different musical effect.

In Chapter I will be found a discussion of the problem, the assumed value of the results to manufacturers of oboes, with a statement of limitation and the results expected. Chapter II deals mainly with the historical background of the oboe with the emphasis on constructional improvements, while in Chapter III the apparatus and tools used are illustrated and described along with the procedure followed in the collection of the various data. Chapter IV presents the findings of the study as they relate to the various classes of oboes therein called excellent, good, and fair. This represents a survey of approximately seventy-five oboes with the data pertaining to a selected forty-five instruments recorded in minute detail. The relationship of the bore to musical effectiveness is shown through the unique pattern formed by those of a single class. From the data collected there emerges a number of bore patterns or designs which are directly related to musical effectiveness. This bore pattern which is peculiar to a given class has a rather wide range of tolerance in the fair class of oboes, with the range of tolerance becoming less and less in the good and excellent classes respectively. This chapter also presents briefly by photographs and description the tonal characteristics of the three classes of oboes as determined through the use of an oscilloscope. In Chapter V the data pertaining to the size of the tone holes, placement, and amount of chamfering, is presented and evaluated.

Chapter VI presents the conclusions of the study which are summed up as follows: If the tone of an oboe is to be aesthetically pleasing, its bore must conform to a definite pattern of deviations from a true cone, and this pattern must be one of proportion related to the true cone formed between the initial or starting diameter and the final or maximum diameter. The thickness of the body also affects slightly the tone quality and pitch; however, the size and placement of the tone holes determine the basic pitch, but have little to do with quality except whem chamfering or phrasing is present. A so-called ideal set of bore, body, and tone hole specifications is proposed whose use in the manufacture of an oboe should bring about a musically aesthetic result superior to that heretofore obtained.

Microfilm copy of complete manuscript of 321 pages, $4.01. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1529.

DEVELOPMENT OF A MUSICIANS INTEREST INVENTORY FOR USE IN VOCATIONAL AND EDUCATIONAL GUIDANCE

(Publication No. 5878)

Kenneth O. Snapp, Ph.D.
Indiana University, 1953

Submitted in partial fulfillment of the requirements for the degree Doctor of Philosophy in the Graduate School, Indiana University, June, 1953.

The research problem was the construction of an interest inventory with appropriate scales for use in counseling college level music students of sophomore or junior standing.

One hypothesis to be tested was whether music is a diversified enough field that people of widely dissimilar interests may find satisfaction in one of its various aspects.

A second hypothesis to be explored was whether differences in interests between specialty groups in music education are at least as great as those between music teachers and professional musicians (represented in this study by symphony musicians.)

The Musicians Interest Inventory, a testing instrument containing a total of 470 specific-to-music as well as general items, was developed. It was distributed to a total of 2,780 professional specialists in the following four categories: teacher of college level theoretical music, teacher of college level applied music, teacher of public school music, and symphony musician.

Scales were constructed on the basis of differences in response to each of the items by 854 vocationally satisfied members of the four groups. The mean responses of each of the four specialist groups to every item were contrasted in turn with the composite mean responses of the other three groups. A difference of eight percentage points was chosen as significant in the assigning of weights.

Pearson product-moment correlation coefficients were next computed from raw scores on each pair of scales.

Intercorrelations of the four scales were as follows: college theoretical vs. college applied, .76; college theoretical vs. public school, -.88; college theoretical vs. symphony, .25; college applied vs. public school, -.82; college applied vs. symphony, .13; and public school vs. symphony, -.49. Average correlation between the scales was -.27, while the average test-retest reliability for the four scales was estimated at .93.

Raw scores were converted to letter grades on the basis of standard scores, thereby providing a second measurement of the differentiating effectiveness of each scale.

The percentage of each letter grade obtained by a criterion group on its own scale was contrasted with grades by other groups on the same scale. Degree of resemblance between the group scores was expressed in terms of percentage of overlap, defined as the percentage of scores earned by one group which could be matched by scores earned by the other group.

The mean percentage of overlap found for each scale was: college theoretical, 39; college applied, 64; public school, 29; and symphony, 36.

Conclusions drawn from responses on this inventory are:

1. The four scales differentiated extremely well between every combination of musical specialty groups except the college theoretical and college applied; differentiation between the latter two groups can be considered only fairly effective.
2. Interests of college teachers and symphony musicians are more closely related than those of college and public school music teachers.
3. Interests of public school music teachers are strikingly dissimilar to those of the other three groups.
4. In terms of overlap, the public school music teacher scale is the most effective of the four scales.
5. The high estimated reliability implies at least reasonable stability of scores.
6. The Musicians Interest Inventory should be administered to a large sampling of college level sophomore or junior music students and a follow-up study made to test its effectiveness as a vocational and educational guidance instrument.

Microfilm copy of complete manuscript of 256 pages, $3.20. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1530.

PHYSICS, GENERAL

ANOMALOUS OSMOTIC PRESSURES OF POLYMER SOLUTIONS AS MEASURED IN A METAL MEMBRANE OSMOMETER

(Publication No. 5505)

Thomas A. Barr, Jr., Ph.D.
Vanderbilt University, 1953

Supervisor: Professor Ingram Bloch

The osmotic pressure phenomenon in metal membrane osmometers was first investigated by Matthews.[1] His experiments dealt principally with the observed osmotic pressures of the polyethylene glycols in water. Rhody[2] also examined the same polymer-solvent system at zero pressure difference across the membrane and determined the flow rate of solute through both metal membranes and dialysis materials. The outstanding features of both of these investigations were the increase of osmotic pressure and the leveling off of diffusion rates at high concentrations. It is the purpose of this paper to tie together the experimental data of the afore-mentioned authors, as well as that obtained by this writer, with the present and proposed theories for osmotic pressure and diffusion.

Two approaches have been made to the problem: first, the non-mechanistic or thermodynamic approach, and, second, the mechanistic or kinetic approach. In the thermodynamic approach, the problem was attacked by means of a negative pressure osmometer (a thermodynamic device), and an expression was derived for the osmotic pressure of a system in which the solute as well as the solvent is volatile; i.e., the solute penetrates the membrane. It was also necessary to postulate a membrane factor, B, which is a function of the ratio of the membrane pore size to the solute molecule size. The formula thus derived for osmotic pressures in a metal membrane osmometer is $\pi_o = RT \ln \frac{a^o_1}{a_1 + Ba_2}$, where π_o is the observed osmotic pressure, R is the gas constant, T is the absolute temperature, a^o_1 is the activity of the pure solvent, a_1 is the activity of the solvent in solution, and a_2 is the activity of the solute in solution. In the kinetic approach it was postulated that the solutions and solute involved follow the well-established laws of osmotic pressure, capillary flow, and diffusion. A model for the osmometer was described, and the observed osmotic pressures in this model were related to the afore-mentioned laws. From this relation the diffusion conefficient, $_oD$, for the polymers in solution was determined as a function of the polymer molecular weight, M_2, and the polymer submolecular weight, M'_2, $D = K^{LV} RTM'_2 (M_2^{-1.139} 4.59 \times 10^{-7}) M_2^{.139}$, where K^{1V} is a constant which depends on the membrane pore size and the volume of fluid removed from the osmometer with each polymer submolecule.

It was experimentally verified that when a pressure, p(o), in excess of the observed osmotic pressure, $\pi_o(o)$, was applied by raising the solution height, h, in the osmometer stem, the flow rate out of the osmometer was of a compound exponential form. $\rho (dV/dt) = -\lambda_1 A' p(o) \exp. (-\lambda_1 t) - \lambda_2 A' \pi_o(o) \exp. (-\lambda_2 t)$, where ρ is the solution density, (dV/dt) is the flow rate out of the osmometer, A′ is the cross-section area of the osmometer stem, and λ_1 and λ_2 are the two time-dependent decay constants. It was shown that λ_2 could be expressed as a function of D. A factor, λ' of D, and, therefore, of λ_2, was shown to have the same general functional form as the membrane factor, B. The influence of the metal membrane on the observed osmotic pressure may be ascertained from an examination of the variation of D with M_2 or the variation of λ' with M_2.

1. D. E. Matthews, A Study of the Semipermeability of Silver Membranes, Vanderbilt University, 1950.

2. R. E. Rhody, Flow Rates Through Metal Membranes, Vanderbilt University, 1951.

Microfilm copy of complete manuscript of 91 pages, $1.14. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1531.

THE DE HAAS-VAN ALPHEN EFFECT IN TIN RICH TIN-ANTIMONY ALLOYS

(Publication No. 5581)

George Thomas Croft, Ph.D.
University of Pennsylvania, 1953

Supervisor: Foster G. Nix

A survey of the theoretical developments in the de Haas-van Alphen effect from 1933 to 1952 is given in which the effects of electron spin and collision broadening are discussed.

A new technique of measuring the de Haas-van Alphen effect is presented. Using this method, a continuous recording of the torque acting on a metal single crystal as a function of the magnetic field can be obtained.

The de Haas-van Alphen effect has been measured in tin and tin antimony alloys; where particular care was taken to control the composition and thermal equilibrium state of the alloys. The temperature dependence of the amplitude of the de Haas-van Alphen effect oscillations in tin and the alloys is correctly predicted by the theory (if we use the effective mass

parameters as obtained by experiment) over the range in which the effect was investigated (3.3° K to 1.4° K). There is some evidence that the field dependence of the amplitude of the oscillations is given by a higher power of H^{-1} than 3/2.

An analysis of the data shows that the effective mass parameters and the Fermi level associated with the de Haas-van Alphen effect electrons are unaffected by alloying within the limits of experimental error (±10%). The highest concentration of Sb in Sn used was 0.2 of an atomic percent.

The collision broadening parameter, X, is affected by alloying. X increases linearly with the atomic percent of Sb added to the Sn lattice. The values of X obtained for pure Sn(≃0.1°K) are a factor of 10 less than the values quoted by Shoenberg (1952). This is attributed to the careful handling and to the heat treatment given the samples.

There is evidence that the parameter X is dependent on the angle between the tetragonal axis of the crystal and the magnetic field. X for a .026% Sb sample increases from 0.26°K at θ = 2.5° to X = 1.25°K at θ = 32.5°. Similar behavior is observed in a .043% Sb sample.

A tentative theory is given in order to explain the apparent angular dependence of X on θ.

The room temperature differential susceptibility of Sn and the Sn-Sb alloys has also been measured. It has been found that the differential susceptibility increases by approximately 20% when the Sb concentration in Sn is increased by only 0.2%.

Microfilm copy of complete manuscript of 156 pages, $1.95. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1532.

AN EXPERIMENTAL MEASUREMENT OF THE GYROMAGNETIC RATIO OF THE FREE ELECTRON

(Publication No. 5698)

William Henry Louisell, Ph.D.
University of Michigan, 1953

It is known that a measurement of g for a free electron by a Stern Gerlach or magnetometer type experiment would be in conflict with the uncertainty principle. Several alternative schemes not in conflict with the uncertainty principle have been advanced. The only one which has yielded even partial success is the double scattering of electrons on nuclei. Theory predicts partial polarization in the first scattering event, and asymmetry in scattered intensity in the second. Success to the extent of showing that a polarization exists has been reported, but no experiment has yet yielded a quantitative value of g.

An extension has been devised to the above experiment in which a magnetic field is interposed between the two scatterers, parallel to the path of the electron. This makes the electron moment precess and rotates the plane of asymmetry in the second scattering event, giving a measurement of g. The field must be nearly uniform to prevent depolarization. By comparing the precession and cyclotron frequencies, the electron measures the magnetic field.

An experiment on the double scattering of 420 kev electrons on nuclei has been performed by the modifications to the double scattering experiment proposed above. First and second targets are 24 feet apart on the axis of a 30-foot, 6-inch diameter solenoid, producing 93 gauss. The electron moments precess through 5 revolutions in flight between the two scatterers. At the second scattering station, two scintillation counters are placed at 78° from the axis of the solenoid and opposite in azimuth. These, with the second scatterer constitute a head which can be rotated about the axis of the solenoid. A measurement through 360° removes effects from inherent differences in the counters, and determines the plane of asymmetry of the scattered electron intensity. Pulse-height discrimination reduces the effects of slow (inelastically scattered) electrons. The first scatterer is gold. Alternately the second is gold, silver and aluminum, of equal scattering power. All other conditions are constant. The polarization asymmetry is obtained from the ratio of the gold to aluminum intensities, and from the ratio of the silver to the aluminum intensities. This eliminates asymmetries other than polarization and gives a check on the Z dependence of the polarization asymmetry. Three measurements, in which the precession was 1770, 1800 and 1830 degrees were made. The value of g obtained was 1.99 ± 0.02. The magnitude of the asymmetry is about 1/2 that predicted, suggesting some depolarization.

Microfilm copy of complete manuscript of 115 pages, $1.44. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1533.

ZINC OXIDE, SEMICONDUCTOR AND ADSORBENT

(Publication No. 5609)

Stanley Roy Morrison, Ph.D.
University of Pennsylvania, 1953

Supervisor: Park H. Miller, Jr.

Part I. Some Semiconductor Properties of Zinc Oxide and Their Interpretation

Bevan and Anderson's hypothesis that chemisorbed oxygen has a controlling effect on the conductivity of zinc oxide at high temperatures has been verified. The concept has been expanded to show that the second electron on these chemisorbed oxygen ions has a controlling effect on the conductivity in the range from room temperature to 500°C.

It has been shown that the trap level corresponding to the first electron on the chemisorbed oxygen is at least an energy 3.1 e.v. below the conduction band, while that corresponding to the second electron is at about 0.8 e.v. below the conduction band at the surface.

Part II. Adsorption of Oxygen in Zinc Oxide

It has been shown that oxygen is adsorbed on zinc oxide. The total adsorption has not been measured, but it has been shown that when the zinc oxide is heated above 500°C, oxygen previously adsorbed on the sample is desorbed, leaving adsorption sites. The number of these adsorption sites prepared increases rapidly with increasing cleaning temperature. With a constant number of adsorption sites, it has been shown that the amount of oxygen adsorbed is maximum at about 425°C.

It has been shown that the number of adsorption sites decreases with time, if the sample is held in vacuum at a high temperature. The reverse effect, creation of adsorption sites by high oxygen pressures at high temperatures has been observed. Suggestions of possible mechanisms for the variation in the number of adsorption sites have been made.

Part III. A Theory of Adsorption

From the results of Part I of this report, a model to explain the adsorption of hydrogen and other gases on zinc oxide has been suggested. The adsorption involves binding the adsorbate to singly ionized oxygen ions present on the surface. Extension of this model to other substances has been suggested.

Microfilm copy of complete manuscript of 46 pages, $1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1534

A HIGH ENERGY LINEAR ELECTRON ACCELERATOR

(Publication No. 5807)

Richard Barr Neal, Ph.D.
Stanford University, 1953

This report deals with the design of a high energy linear electron accelerator of the traveling wave type. In particular, the design and manufacture of the Stanford Billion Volt Accelerator are covered in some detail.

The effects of constructional errors, frequency deviations and temperature variations on the performance of the linear accelerator are discussed. Methods of assembly and support of the accelerator, and the alignment problem are considered. Vacuum requirements and field emission problems are studied, and a specific vacuum system is described.

Generation of R. F. power for the accelerator is discussed, and a brief description of the klystron amplifiers and their associated components is given. The R. F. transmission components, which carry low level power to the klystrons and high level power from the klystrons to the accelerator, are described.

The general subject of injection and binding of electrons into accelerating orbits is covered with specific numerical examples being given. Methods of initially bunching the electrons are discussed, and the detailed design of a buncher of the tapered, disc-loaded type is worked out. Fabrication of this buncher is described, and results of tests are related and analyzed.

The effect of the earth's magnetic field on the electron beam passing through the accelerator is calculated, and means of attenuating and compensating this field are discussed.

A brief description of the target end equipment is given, and techniques which have been used in measuring the characteristics of the electron beam are described. Preliminary operational results obtained with the Stanford Accelerator are reported.

Microfilm copy of complete manuscript of 398 pages, $4.98. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1535.

SOME ASPECTS OF THE LUMINESCENCE OF CHEMICALLY PURE ZINC OXIDE

(Publication No. 5612)

Theo Todd Reboul, III, Ph.D.
University of Pennsylvania, 1953

Supervisor: Park H. Miller, Jr.

Samples of ZnO, sintered from spectroscopically pure powder, have been examined at various temperatures for luminescent properties when excited by X-rays. There are two luminescent peaks, one at 395 millimicrons and the other at 520 millimicrons. The intensity of the 395 mμ peak increases at a faster rate than the intensity of the 520 mμ peak as the sintering increases. The 395 mμ peak has a decay time of less than 10^{-5} seconds at all temperatures between 100° K. and 300° K. When using shuttered excitation, the 520 mμ peak has a decay time which changes from about 4×10^{-4} seconds at 125° K. to a microsecond at room temperature. The total luminescence from single crystals of ZnO are partially polarized.

Thermoluminescence experiments show that only the 520 mμ peak is emitted during the heating process and that its temperature of peak emission does not depend on excitation but does depend upon the heating rate going from 137° K. at 1.6° K. per minute to 154° K. at 18° K. per minute. From the heating rate-peak temperature data, the activation energy of the traps responsible for the thermoluminescence is found to be .25 ev. An incompletely resolved second peak in the thermoluminescence curve has been shown by theoretical considerations to be due to a level of traps having an activation energy of .28 ev. A value of s-the luminescent probability constant-has been calculated from the thermoluminescent data to be 10^7 per second.

The number of traps responsible for the long time decay of the 520 mμ peak as well as the effect of thermoluminescence is found to be 10^{13} per cc.

From calculations of data from combined photoconductivity and luminescence experiments, it seems that there is no correlation of these two mechanisms.

Finally, a model of the energy level structure in

sintered ZnO, consisting of donors near the conduction band, a slightly smaller number of acceptors near the middle of the forbidden gap and an even smaller number of luminescent centers lying near the filled band can account for the observed thermoluminescence, the interesting feature of which is its existence in a material having an appreciable number of electrons in the conduction band at the temperature of irradiation. In brief, statistical fluctuations in acceptor density result in some luminescent centers being surrounded by an accumulation of negative charge. Unless the conduction band electrons are given enough thermal energy to penetrate the shielding as during thermoluminescence, the luminescent centers remain activated.

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VIBRATIONS OF A FLUID STREAM IN AN ELASTIC TUBE

(Publication No. 5516)

Donald Robbins, Ph.D.
Vanderbilt University, 1953

It is observed that when an elastic tube has a fluid flowing through it and is constricted by an elastic constriction, there may be vibrations of the constriction and also a pulsing of the fluid in the tube as its velocity alternately increases and decreases synchronously with the vibration of the constriction.

The general hydrodyamic equations of motion are specialized to this particular case and then combined with the equation of continuity and a derived pressure-radius relation to give second-order partial differential equations which approximately describe the motion of the fluid in the tube. These equations are solved for the pressure and velocity of the fluid in the tube as functions of time and position.

The tube at the constriction is considered. An expression is written for the force on the stirrup which constitutes the constriction. This is combined with an expression for the constriction opening derived from the equation of continuity applied at the constriction itself. After manipulation the equation that results is

$$(\omega M - \frac{K_1}{\omega}) \pm \frac{Gke\rho}{A} \tan \omega L/c \pm i(G' v_o - R) = 0,$$

where M is the mass of the stirrup, K_1 is the effective spring constant of the stirrup, ω is the angular frequency of vibration, G, G', k, are constants, A is the average cross-sectional area of the tube, c is the wave velocity, ρ is the density of the fluid in the tube, L is the length of the elastic tube from the constriction to the open end, v_o is the average water velocity, and R is the resistance of the stirrup.

It is shown that a condition for oscillation is $G' v_o \geqslant R$. This condition was checked qualitatively by variation of v_o and R. It was also checked qualitatively by means of the time-average pressure measured in the throat of the constriction and used in conjunction with the threshold oscillation curve.

The variation of ω with K_1, M, and L was checked experimentally for three different tubes. The ω, read by means of a direct-reading frequency meter, was compared to the ω calculated by graphical means from the transcendental equation. The variation of ω with M, K_1, and L, was as predicted by the theory to within experimental error.

The variation of ω with L is the main effect. While L changes from 6 cm. to 180 cm., the corresponding change in frequency is from about 50 cps. to 2 cps. for tube 1. When 1/L is plotted vs. ω, a straight line can be drawn through most of the experimental points. The line does not go through the experimental points at the extremes. At the lower end the frequency is low and hard to measure. At the upper end the L is difficult to measure precisely. This straight line is a substantiation of the standing-wave hypothesis in the development of the theory. From coupling and energy considerations it is decided that the standing waves are dilational waves on the elastic tube.

The frequency of oscillation usually corresponds to approximately one-quarter of a wave length for the standing wave. However, it is sometimes possible for the tube to oscillate with a standing wave of three-quarters of a wave length.

This problem has not been completely solved. However, very satisfactory quantitative checks are gotten for the frequency variation with L, M, K_1. The frequency variation with flow rate and the conditions for oscillation are explained in a reasonable qualitative manner within the framework of the theory. The absence of real knowledge as to what is actually happening in the constriction proper is the factor that prevents quantitative checks here. For all the apparent simplicity of the system, there are actually complicated phenomena occurring, and it is surprising that as many checks as occur can be gotten from the simplified approach used.

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THE INFRARED ABSORPTION SPECTRA OF DIAMOND, SILICON, AND GERMANIUM

(Publication No. 5733)

William Goodrich Simeral, Ph.D.
University of Michigan, 1953

The purpose of this study is to explain, in so far as possible, the origin of the infrared absorption bands in diamond. Silicon and germanium have been studied because they have the same crystal structure as diamond, and hence can be expected to show similar absorption spectra. This study was motivated by the fact that many of the structure sensitive properties, such as the ultraviolet transmission limit, X-ray

diffraction pattern, visible absorption spectrum, and infrared absorption spectrum, show anomalous variations. In particular, the infrared absorption spectra of diamonds are composed of two distinct parts: (1) From 2 to 6 μ the absorption spectra of all diamonds are the same. (2) At wave lengths longer than 6 μ, the absorption spectra are anomalous in that the absorption coefficients of bands in this wavelength region vary from diamond to diamond.

The following experimental work was performed: (1) Infrared absorption spectra of diamonds were recorded between 1 and 100 μ . Previously unreported bands were found at 6.5 and 30 μ . No abosrption was detected at wavelengths longer than 33 μ . (2) In one diamond, variations in the absorption of 2537 A. U. radiation were found to correspond to variation in the absorption of 7.8 μ radiation. (3) The absorption spectra of diamonds were recorded between 1200 and 3000 A. U. No transmission was detected at wavelengths shorter than the cutoff (between 2250 and 3200 A. U. depending on the diamond). (4) Diamonds were bombarded with deuterons and neutrons. While marked changes occurred in the visible spectrum, no changes occurred in the infrared spectrum. (5) The infrared spectra of five germanium samples (three pure, two impure due to the addition of arsenic) were recorded from 1 to 100 μ . In all samples absorption bands were found between 11 and 100 μ . The impure samples absorbed more strongly than the pure samples between 33 and 100 μ .

In the theoretical portion of this work, the frequency distributions of the vibrational modes of diamond, silicon, and germanium are calculated using the Born theory of lattice dynamics. Some of the results of H. M. J. Smith's work on diamond are used for these calculations. The infrared absorption spectra of diamond, silicon, and germanium are interpreted in terms of (1) absorption by fundamental vibrations, (2) absorption by combinations of fundamental lattice vibrations.

From the results it is shown that the absorption by fundamental lattice vibrations in silicon and germanium is consistent with the hypothesis that the presence of more than one isotope breaks down the selection rules which normally forbid fundamental absorption in these substances. It is also shown that the absorption in the fundamental frequency range of diamond is consistent with the theory, proposed by Sutherland and Blackwell, that the presence of impurities breaks down the selection rules for fundamental absorption and also introduces new vibrational frequencies which are not characteristic of the pure diamond lattice.

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EFFECTS OF CERTAIN THREE-BODY NUCLEAR INTERACTIONS IN H^3 AND He^3

(Publication No. 5517)

Alfred William Solbrig, Jr., Ph.D.
Vanderbilt University, 1953

Supervisor: Ingram Bloch

This thesis reports a limited theoretical study of certain three-body nuclear interactions and their effects on the wave functions, magnetic dipole moments, and binding energies of the nuclei H^3 and He^3. This study may be of use in further work in which these interactions are combined with other interactions to describe nuclear properties in a more comprehensive way. The treatment is phenomenological and nonrelativistic, and the effects of the interactions are obtained by first-order perturbation methods. The interactions considered (a) satisfy well-known general requirements of invariance, (b) contain no power of momentum higher than the first, (c) involve no dependence on charge, and (d) introduce only P state in a first-order calculation. The interactions contain spin-orbit interactions and may give rise to interaction moments. All permissible forms of three-body isotopic operators which may enter the interactions are written. Since only interactions which contain the isotopic operator 1 are considered, the interactions introduce no exchange moments. Each interaction is of the form $f_{ij}\underline{S}_i\cdot\underline{K}_j$, where f_{ij} is a scalar radial function independent of momenta and $\underline{S}_i$ and $\underline{K}_j$ are axial vector operators in spin and in configuration space, respectively. Effects of linear combinations of the three-body interactions are not necessarily additive, but such combinations are not considered. The methods of Sachs and Austern are used to construct the interaction moment operators arizing from the interactions.

The unperturbed potential corresponds to simple pairwise Hooke's law forces between nucleons. The eigenfunctions of the unperturbed Hamiltonian are obtained by separation in normal coordinates, and these eigenfunctions consist of products of Hermite functions of the normal coordinates. The ground state is taken to be a ^2S state, antisymmetic under interchange of spin coordinates of identical particles. The space dependence of this ground state is such that all two-body interactions which satisfy the general requirements of invariance and are of the first degree in momenta give no perturbing wave function. For convenience in later calculations, the second- and fourth-degree excited energy eigenfunctions are expressed as linear combinations of eigenfunctions of orbital angular momentum of the three-body system.

The first-order energy perturbation is shown to vanish for all the three-body interactions. More detailed consideration of energies is not undertaken because the perturbed potential is unsuitable for energy calculations. It is shown, by consideration of general properties of the perturbed wave function, the results of Sachs, and the interaction moment operators that (a) no one of the seventy-five interactions yields the observed magnetic moments of H^3 and He^3 by spin

and orbital contribution alone and (b) all but seventeen of the interactions do not yield observed moments even when the interaction contribution is included. Calculations with eleven of the remaining interactions appear difficult. If the scalar radial functions are taken to be certain polynomials in the coordinates of the particles, these calculations are greatly simplified; but no one of the eleven interactions with these radial functions accounts for the observed magnetic moments of H^3 and He^3. In all cases the difference between the calculated moments and the observed moments is several times the experimental error in the observed moments. Calculations with the remaining six interactions are relatively simple, for these interactions lead to no perturbing wave functions and no spin and orbital contribution to the magnetic moments. A plausible form of the radial function is selected, and values of the parameters in this function are found such that each of the six interactions yields the observed magnetic moments of H^3 and He^3.

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X-RAY STUDIES OF ORDER-DISORDER IN Cu-Au ALLOYS

(Publication No. 5626)

Charles Herbert Sutcliffe, Ph.D.
University of Pennsylvania, 1953

Supervisor: Foster G. Nix

X-ray diffraction techniques have been used to study the nature of the order-disorder transformation, long-range order, and short-range order in Cu-Au alloys.

By recording at temperature, the shapes of the diffraction lines from the (4,0,0) reflections of single crystals of alloys containing 15, 20, 23, 28, 30 and 34 atomic percent gold, we were able to determine the nature of the transformation. The data obtained indicate that the order-disorder transformation studied is apparently a classical phase transformation. Although the definite presence of two phases was not positively demonstrated for alloys containing less than 25 atomic percent gold, it is difficult to argue with the resolved x-ray diffraction peaks detected for gold-rich compositions.

Long-range order measurements have been made on the six compositions mentioned above. Although a very small amount of order was detectable in the 15% gold sample, no quantitative measurement was obtainable. Values of S and S^2 have been calculated and plotted against temperature. For a homogeneous phase transformation, S, interpreted in the manner of Bragg-Williams, is a direct measure of the degree of long-range order present. However, for a heterogenous or classical phase transformation, S^2 is simply a factor representing the fraction of the material in the ordered state.

Short-range order parameters have been measured using x-ray diffraction techniques, at three temperatures above the critical temperature of ordering, for a Cu-Au alloy containing 23 atomic percent gold. The diffuse scattered intensity was measured at approximately 900 points within 1/32 of a unit cell, and corrected for the intensity due to factors other than short-range order. A three-dimensional Fourier analysis was made on the short-range order intensities. The Fourier coefficients are then interpreted as short-range order parameters. The data indicate that an alloy containing less than 25 atomic percent Au exhibits a greater tendency to short-range order than does an alloy at the stoichiometric composition. The tendency to what has been referred to as a "liquid-like" distribution about an origin atom in a Cu_3Au alloy, although present, is considerably less in the 23 percent Au sample.

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CREEP OF ZINC SINGLE CRYSTALS

(Publication No. 5499)

Donald Oscar Thompson, Ph.D.
State University of Iowa, 1953

Tensile creep measurements beginning in a tensile strain region of about 10^{-6} have been made upon a set of seven single crystals of zinc of 99.99 per cent purity. The primary orientation angles varied from crystal to crystal, but all the secondary angles were close to zero. A majority of the measurements were made by means of electrical resistance strain gauges, and the remainder were made with an optical lever system. Some of the measurements made in the latter apparatus lasted 100 hours or more, and in both systems measurements were made at several temperatures.

All the creep results obtained in this work can be best described by the single empirical relation

$$\eta = bt^m \qquad (1)$$

proposed by Tyndall, in which η is the shear strain, t is the time after completion of the application of stress to the crystal, and b and m are constants for a given creep test under given experimental conditions. It is found, as reported by Tyndall, that b increases exponentially with the stress, and further, that b and the plastic shear strain which occurs during the loading process obey the same stress dependence and are proportional with respect to this variable. In addition it is found that the values of m vary quite regularly with temperature, and appear to fit best the Boltzmann equation

$$m = n_o \exp(-H/RT)$$

in the temperature interval investigated. For these crystals H = 3,140 cal./mole, m_o = 120, and the temperature at which m = 1 is 58°C.

From the point of view of dislocation theory, the most significant experimental result of the work is the fact that m is greater than unity at higher temperatures. For, when m is greater than unity, a cascade process must be allowed in the propagation of dislocation lines in the crystal such that one working dislocation activates on the average more than one previously idle dislocation line, and so on. At lower temperatures with values of m less than unity each working dislocation starts on the average less than one idle dislocation, and at some particular temperature for which m = 1 each working dislocation line starts on the average just one idle dislocation line with the result that the number of operative dislocations remains constant. Only in the case that m = 1 does the creep proceed at a uniform velocity.

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PHYSICS, ELECTRONICS AND ELECTRICITY

FURTHER STUDIES OF THE MONOTRON OSCILLATOR

(Publication No. 5788)

Nien-chih Chang, Ph.D.
Stanford University, 1953

This thesis reviews and extends the elementary theory of the monotron, developed by Hansen and Alpert, regarding the electronic conversion process and determination of the cavity shape. The topics of starting current, build-up time, available current, and space-charge effects, which were neglected by Hansen and Alpert, are discussed in full. Based on the revised theory, various problems of designing a particular monotron are considered. A brief description of an effort made by the present author to construct and test a 10-cm pulsed monotron is given. Comparisons between theory and experimental results are presented, and discrepancies explained. The presence of unavoidable secondary electron and multipactor loading cannot be treated completely analytically, and future laboratory work will be required to determine the seriousness of their presence. The highest frequency that can be reached by a monotron, from the point of view of practical design problems, is investigated. The remarkable similarity between the monotron and the klystron, as pointed out in this thesis, leads one to believe that the monotron should work nearly as well as the klystron itself.

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SIMULTANEOUS MEASUREMENT OF IONIZATION AND ATTACHMENT COEFFICIENTS

(Publication No. 5896)

Melvin Arnold Harrison, Ph.D.
University of Washington, 1953

Measurements have been made of pre-breakdown currents in four gases: oxygen, air, CCl_2F_2 and CF_3SF_5, all containing electronegative atoms. These currents differ from the behavior previously attributed to all gases in that semi-logarithmic graphs of current plotted against electrode separation at constant E/p exhibit initial concavity and, at low E/p, saturation. Reasons are given for attributing this behavior to the formation of negative ions, principally by dissociative attachment. On this basis, an equation is developed, involving both ionization and attachment coefficients, which gives the dependence of current on electrode separation. By fitting this equation to experimental data, simultaneously measured values of ionization and attachment coefficients can be deduced. In oxygen and air, apparent anomalies in the behavior of these parameters when determined from separate experiments are explained. Ionization is found to commence at lower and attachment to persist at higher values of E/p than previously determined. In Freon-12 (CCl_2F_2) and CF_3SF_5 it is found that the ionization coefficients are about an order of magnitude larger than those found by others for similar gases when no account is taken of possible attachment. Electron attachment cross sections as functions of average electron energy are plotted for air and oxygen and discussed in terms of the dissociative attachment reaction.

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PHYSICS, NUCLEAR

ELECTRO-DISINTEGRATION OF Cu^{63}, Zn^{64}, Ag^{109}, AND Ta^{181}

(Publication No. 5785)

Karl Leslie Brown, Ph.D.
Stanford University, 1953

Electrons from the Stanford 35 Mev linear accelerator were used to study the ratio of the (γ,n) photodisintegration cross-section (integrated over the thin target Bremsstrahlung spectrum) to the (e,e' n) electro-disintegration cross-section for the isotopes Cu^{63}, Zn^{64}, Ag^{109}, and Ta^{181}. This ratio was investigated over the energy range of 24-35 Mev.

The experiment was one of the stacked foil type in which the electron beam passed successively through a thin foil of the element being studied, a

copper radiator to produce the Bremsstrahlung, and a second thin foil. The resulting foil radioactivities were measured with geiger counters and from the observed activities the ratio of the two cross-sections was deduced. The probable error was less than $\pm 5\%$ for all experimental values.

The conclusions which may be drawn from the experimental results are as follows.

1) It is observed that the Weizsäcker-Williams approximation (which predicts a constant ratio independent of energy and atomic number) underestimates the electro-disintegration cross-section in comparison with the photodisintegration cross-section. However, it does yield a result which is within a factor of two of the observed ratio for tantalum, and for the lower Z elements, copper, zinc, and silver, the agreement is within 10-15%. In all elements studied the agreement improves as the bombarding energy is decreased.

2) Blair[1] has calculated this ratio in the Born approximation assuming a compound-nucleus model. The photonuclear effect is calculated by the standard method of multipole expansions; and the electronuclear effect is calculated by use of a multipole expansion of the Møller potentials which is equivalent to the use of plane wave solutions for both the incoming and outgoing electrons. The calculations were carried out for the electric dipole, magnetic dipole, and electric quadrupole terms. For the conditions of this experiment it was necessary to make corrections to the Blair theory to account for the contribution of atomic screening to Bremsstrahlung.

Levinger and Bethe[2] suggest that the main photonuclear absorption mechanism is electric dipole and estimate the total electric quadrupole absorption to be only of the order of 6% of the total absorption. By total cross-section is meant the sum of all such processes as (γ,n), (γ,p), $(\gamma,2n)$, etc. Comparison of their calculated value of the total integrated cross-section for the electric dipole absorption with the experimentally determined (γ,n) cross-sections indicates that the (γ,n) reaction accounts for about half of the total photon absorption in the base of Cu^{63}, Zn^{64}, and possibly Ag^{109}.

There is evidence that electric dipole absorption may be forbidden in the vicinity of threshold, whereas electric quadrupole is not. This suggests that the electric quadrupole absorption is due to the (γ,n) reaction. It is expected, therefore, that about 12% of the (γ,n) cross-section is due to electric quadrupole excitation. The results of this experiment seem to be in agreement with such an assumption for Cu^{63}, Zn^{64}, and Ag^{109}, but disagree for Ta^{181}. The disagreement for tantalum may possibly be attributed to a failure of the Born approximation in the Blair theory.

1. J. S. Blair, "Summary of Calculations on Electron Disintegration of Nuclei." (Department of Physics, University of Illinois, 1948.) (Mimeographed.)

2. J. S. Levinger and H. A. Bethe, Phys. Rev. 78, 115 (1950).

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A SEARCH FOR ANOMALOUS ABSORPTION OF NEGATIVE COSMIC RAY PARTICLES AT SEA LEVEL

(Publication No. 5894)

William Randall Davis, Ph.D.
University of Washington, 1953

A search has been made for negatively charged non-electronic cosmic ray particles at sea level that are stopped in 147 g/cm^2 of lead by catastrophic nuclear collisions. The momentum and sign of the charge of those particles stopping in the absorber were determined by means of a counter-controlled cloud chamber operated in a magnetic field. The geometry and associated electronic circuits of the anticoincidence Geiger tray were such that the efficiency of this tray was at least 99.98%. During the course of the experiment no negatively charged particle in the momentum interval 0.37-1.67 bev/c was recorded as stopping in the absorber. This result has been used to place an upper limit of 2.5×10^{-3} particles /cm^2 steradian hr on the sea level flux density of negative protons in the momentum interval 0.69-1.75 bev/c. With the assumption that pi mesons have the same mean path for removal by catastrophic collisions as do protons, it has been shown that the intensity at sea level of negative pi mesons in the momentum interval 0.45-1.75 bev/c cannot be as great as 2.5×10^{-3} particles/cm^2 steradian hr, or as much as 0.05% of the total intensity of negative mu mesons in this momentum interval. A lower limit of 6.9×10^5 g/cm^2 or 6.1×10^4 cm of lead has been set on the removal path length of mu mesons in the momentum interval 0.37-1.67 bev/c. It has been shown that the local production of negative mu mesons in the momentum interval 0.45-1.02 bev/c is less than 8.8×10^{-5} particles/cm^2 steradian hr meter. It has been pointed out that there may be a measurable intensity of anomalous absorption of negative particles at an altitude of 3.4 km.

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K/L+M INTERNAL CONVERSION RATIOS FOR M4 TRANSITIONS

(Publication No. 5317)

Glen Atkins Graves, Ph.D.
Indiana University, 1953

Before describing the series of measurements which resulted in a new curve of K/L+M ratios for M4 transitions, attention is devoted to the concepts

which underlie the use of radioactivity measurements to classify nuclear transitions in which the atomic number does not change.

Isomeric processes are discussed and the traditional significance of angular momentum and parity for the lifetimes of radiative transitions is reviewed. The parity and angular momentum properties of electromagnetic multipoles are stated, and a table of minimum allowed multipoles for arbitrary radiative transitions is presented. This is combined with an expression for the rate of radiation of an oscillating distribution of charge to deduce the probable radiation of transitions of given spin and parity change. Parity allowed and parity forbidden transitions are defined and explained.

The coefficients appearing in the recent radiative transition lifetime-energy relations of Moszkowski and Weisskopf have been evaluated for all multipoles and the results are presented in convenient, two-parameter tables of order-of-magnitude formulae.

The most significant aspects of the internal conversion effect are presented. The effect and its historical interpretations are described; the total and partial internal conversion coefficients are defined and the transition selection rules stated. The reasons for requiring relativistic treatments of the conversion of s electrons by magnetic multipoles are explained. The manner in which the internal conversion coefficients vary with energy and multipole order is discussed along with a review of theoretical calculations upon the subject.

Reasons are given for the recent trend toward a semi-empirical classification of isomers and the validity of this method is implied. In particular, the results obtained by Goldhaber and Sunyar in their extensive use of this method are reviewed.

Data obtained in this experiment indicate that some modification is necessary for one of the curves presented by Goldhaber and Sunyar. A high resolution, semi-circular focussing nuclear spectrometer has been employed to study the internal conversion lines of six magnetic four pole transitions. The K/L+M internal conversion ratios obtained by comparing areas are shown to fall substantially lower than would be expected from the previously published curve in the region of low values of Z^2/E.

A revised curve is presented based partly upon new results in the literature and principally upon the following values for the transition energies and K/L+M ratios: Y^{91}, 551.2 kev., 6.00; Sr^{87}, 388.2 kev., 5.79; Y^{87}, 381.3 kev., 5.41; Ba^{137}, 661.4 kev., 4.64; In^{113}, 391.7 kev., 4.21; and In^{115}, 334.6 kev., 3.76. Values are also given for transitions in Cd^{111} and In^{114}. The new curve is explained and discussed and possible reasons for the discrepancies are considered.

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NUCLEAR DISINTEGRATION SCHEMES OF Rb^{82}, Rb^{84}, Ru^{103}, Pd^{103}, AND As^{72}

(Publication No. 5866)

Charles Martin Huddleston, Ph.D.
Indiana University, 1953

The nuclear spectra of Rb^{82} (6.3 hr.) and Rb^{84} (34 d.), and of Ru^{103} (43 d.), Pd^{103} (17 d.), and Rh^{103m} (56 min.), and of various radioactive arsenics have been studied using a magnetic lens spectrometer.

Rb^{82} emits two positron groups of energies 0.775 and 0.175 Mev. It also decays by orbital electron capture. A large number of gamma-rays accompanies the disintegration. Reasonable agreement with the gamma-rays emitted by Br^{82} has been obtained. Rb^{84} emits three groups of positrons having end-point energies of 1.629, 0.822, and 0.373 Mev. One gamma-ray whose energy is 0.890 Mev has been found. Level diagrams for these disintegrations are discussed.

Ru^{103} disintegrates with the emission of two beta-ray groups of end-point energies 0.684 Mev (6 per cent) and 0.204 Mev. (94 per cent) together with a gamma-ray of 0.494 Mev and an internally converted gamma-ray of 40.4-kev energy. Pd^{103} disintegrates by orbital electron capture. The spectrum consists of an electron line at 36.9 kev, shown to be due to L-electrons from a highly converted gamma-ray of 40.4 kev energy, together with Auger electrons. The spectrum of the metastable Rh^{103m}, whose half-life has been determined as 56 min., consists of an L-conversion line for a gamma-ray of 40.4 kev, with some indication of the presence of the K-line. Ru^{97} (2.8 d.) was also measured and found to emit a gamma-ray of 0.217 Mev.

The arsenic isotopes, produced by high energy alpha-particle bombardment of gallium, consist of As^{72} (26 hr.), As^{74} (19.5 d.), As^{73} (90 d.), and As^{71} (60 hr.). The main investigation concerns As^{72}. This element is found to emit five positron groups of end-point energies 3.339 (19.3 per cent), 2.498 (64.6 per cent, 1.844 (12.1 per cent), 0.669 (5.0 per cent), and 0.271 (2.0 per cent) Mev. A strong gamma-ray of energy 0.835 Mev together with many weak gamma-rays with energies up to 3 Mev have been found. The levels of the product nucleus Ge^{72} agree well with those found from a study of Ga^{72}. The highest energy positron group has a forbidden shape. The spectrum of As^{74} consists of one gamma-ray of energy 0.593 Mev, two negatron groups of energies 1.45 and 0.82 Mev together with a positron group of energy about 0.96 Mev. As^{73} disintegrates by K-electron capture and the emission of an internal conversion line corresponding to a gamma-ray of 0.052 Mev. An internal conversion line corresponding to a gamma-ray at 0.162 Mev is ascribed to As^{71}.

A design for a high transmission magnetic lens spectrometer is proposed. The lens has a U-shaped axial magnetic field with a negative value of $\partial H_z/\partial_r$ inside the focusing region in order to

minimize spherical aberration and to achieve a large solid angle of acceptance. The desired field shape is attained by placing, at source and detector ends, magnet coils with triangular cross-sections. No iron is used in the instrument. Coil winding and heat dissipation problems are discussed. Theoretical arguments are given for expecting the lens to yield a transmission of 8 per cent at a resolution of 4 per cent.

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BETA-RAY AND GAMMA-RAY ENERGY MEASUREMENTS WITH A THIN-LENS MAGNETIC SPECTROMETER

(Publication No. 5683)

Donald Raymond Hutchinson, Ph.D.
University of Michigan, 1953

The purpose of this research was twofold: first, to revise and refine a thin-lens magnetic spectrometer so as to measure beta-ray and gamma-ray energies with greater accuracy than was heretofore possible with this instrument, and second, as a consequence of the first, to make measurements and analyses of the beta-spectra of a number of artificially radioactive isotopes, to measure the gamma-ray energies of these same isotopes, and to establish or reinvestigate their decay schemes.

In Chapter II a brief discussion of the theory of beta-ray spectrometers is followed by a detailed description of the thin-lens spectrometer used in this research. From the study of a number of materials regarding their suitability as thin windows for a G-M counter, it was found that laminated films of Zapon showed the most acceptable characteristics for this purpose. For measurements made from strong gamma-ray sources considerable quantities of lead shielding were placed throughout the instrument in order to reduce scattering to a minimum.

Chapters III and IV contain a summary of the theories of beta-decay and the interaction of gamma-rays with matter, along with a discussion of the methods of analyzing experimental data.

In Chapter V an analysis is made of measurements on the following radioisotopes: cesium^{137}, cesium^{134}, hafnium^{181}, antimony^{124}, iron^{59}, and rubidium^{86}. A momentum spectrum and Fermi plot was made for each of the isotopes studied. Measurement of the internal conversion electrons of the 607 kev gamma-ray of antimony^{124} showed its multipole order to be quadrupole. An upper limit was placed on the internal conversion electrons associated with the 1.7 Mev transition with the conclusion that this transition cannot be as highly forbidden as electric octupole or magnetic quadrupole. Analysis of the beta-spectrum of iron^{59} showed the presence of two beta-components of approximately equal intensities and energies of 244 kev and 442 kev. Rubidium^{86} measurements showed the presence of a high energy component of first-forbidden shape. However, analysis of the low energy portion of the spectrum indicated the presence of a beta-component of energy intermediate to the two previously reported beta-transitions.

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ANGULAR DISTRIBUTIONS FROM THE REACTIONS $Cl^{35}(d,p)Cl^{36}$, $Sc^{45}(d,p)Sc^{46}$ AND $V^{51}(d,p)V^{52}$ AS A TEST OF THE SHELL MODEL

(Publication No. 5688)

John Swinton King, Ph.D.
University of Michigan, 1953

This investigation was undertaken to obtain angular distribution of the protons from the ground state reactions $Cl^{35}(d,p)Cl^{36}$, $Sc^{45}(d,p)Sc^{46}$, and $V^{51}(d,p)V^{52}$. These distributions are compared with the calculated differential cross-section curves according to the Butler stripping theory for (d,p) and (d,n) reactions. From this comparison an assignment of an orbital angular momentum state to the captured neutron can be made. These assignments will or will not agree with the predictions of the nuclear shell model. The main point of interest is in the detection of admixtures of orbital angular momentum states since this constitutes a measure of the accuracy of the shell model assignments.

Thin targets of AgCl, Sc_2O_3, and V were bombarded with a collimated beam of 7.8 mev deuterons from the cyclotron. The scattered protons were detected by a double proportional counter telescope and their energy determined by the range-energy method employing variable aluminum absorbers. Counting rates were measured at 5^0 and 10^0 intervals from 0^0 to 90^0.

The results show that in each case the predominant orbital angular momentum state ℓ for the captured particle is in agreement with the value required by the shell model. There is strong indication, however, that a small admixture of ℓ-states does occur in each case. These admixtures are of the order of 3 percent to 15 percent.

The conclusion is that the shell model assignments are not unique in respect to ℓ. This may possibly be interpreted as due to perturbation of the shell model eigenfunctions by the existence of nearby excited levels analogous to "configuration interaction" in atomic physics.

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LOW ENERGY PHOTO-MESON PRODUCTION

(Publication No. 5801)

Robert Davis Lawson, Ph.D.
Stanford University, 1953

This dissertation deals with the photoproduction of mesons when a gamma-ray bombards a hydrogen target. We shall limit our considerations to gamma-ray energies less than 1 Bev. In this energy region, the recoil nucleon may be treated nonrelativistically.

In Chapter I, the photoproduction of π mesons is discussed under the assumption that the nucleon is infinitely heavy. If charge symmetric scalar coupling is assumed, one easily finds a rapidly convergent solution to the meson field eigenvalue problem by including in the zero-order Hamiltonian the neutral meson-nucleon interaction. Instead of the usual perturbation expansion in powers of $g^2/4\pi$, one obtains an expansion in powers of $\frac{g^2}{4\pi}\exp - g^2/4\pi$. The method is used to calculate the cross section for the photoproduction of π^+ mesons. When pseudovector coupling is assumed, only part of the neutral meson-nucleon interaction is included in the zero-order Hamiltonian. The expansion parameter in this case does not always contain the exponential factor. The method is used to calculate the cross section for the photoproduction of π^+ and π^0 mesons. In the latter case we obtain a non-vanishing cross section in the third order of a perturbation calculation. The results obtained for π^0 photoproduction show that the no-spin-flip cross section is reduced relative to the spin-flip part by a factor of the order of 100. This bears out the phenomenological calculations of Drell and Kaplon.

Chapter II gives a brief summary of covariant perturbation theory. The P bracket formalism of Dyson is developed and applied to a particular problem. The concept of a Feynman diagram is introduced and its relation to the P bracket is discussed. Finally the relation between S matrix and cross section is derived.

In the third chapter, the results of Chapter II are used to calculate the cross sections for the photoproduction of π meson pairs. For pseudoscalar mesons interacting with nucleons via pseudoscalar coupling, it follows from a perturbation calculation that the cross section for photoproduction of (π^+,π^-) pairs near threshold dominates other possible meson pair creation cross sections by a factor of the order of $(M/\mu)^2$. This is best seen by transforming the pseudoscalar interaction Hamiltonian with the Dyson transformation. The transformed Hamiltonian can be separated into one large pair term, $2M\frac{g^2}{\mu^2}\int\bar{\psi}\,\psi\phi_\alpha^2\,d\underline{r}$, plus other smaller terms, one of which is the usual pseudovector interaction. This large term gives the dominant contribution to the (π^+,π^-) pair production process, but cannot contribute to the pair process in which one of the mesons is a π^0 and the other is charged, since it cannot change the charge state of the nucleon. The (π^0,π^0) cross section is small in virtue of the fact that the gamma-ray interacts only with the nucleon in this process. Expressions for the possible pair production cross sections are given. Curves for the (π^+,π^-) and (π^+,π^0) cross sections as a function of incident gamma-ray energy are shown for both pseudoscalar and pseudovector coupling. The first-order nucleon recoil correction to the (π^+,π^-) cross section for pseudoscalar coupling is calculated. The possibility of determining the meson-nucleon interaction from a measurement of the meson pairs produced when a gamma-ray bombards a hydrogen target is discussed.

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A STUDY OF THE RADIOACTIVE DECAY OF ANTIMONY 124

(Publication No. 5870)

Norman H. Lazar, Ph.D.
Indiana University, 1953

The radiations from Sb^{124} were studied in an attempt at eliminating the discrepancies appearing in the literature on the subject. The energies of the beta rays were determined in a magnetic spectrometer. An interpretation of the high energy portion of the beta ray spectrum is made on the basis of recent evidence for mixtures of Fermi and Gamow-Teller selection rules in the law of beta decay. The spectrum is fit by a "correction" factor which arises from mixtures of S and T or V and A coupling forms in the interaction Hamiltonian. On the basis of this interpretation, the transition results in $\Delta I = 1$ and a parity change for the nuclear levels involved. A straight-forward Fermi analysis was performed on the remainder of the beta spectrum. Four other beta groups were obtained with energies of .24, .61, .966 and 1.602 Mev.

The energies of the gamma rays emitted were determined in the magnetic spectrometer using photoelectrons ejected from a lead converter. Five gamma rays were found with energies of .603, .641, .716, 1.68 and 2.09 Mev. The internal conversion coefficient for the .603 Mev gamma ray was determined. The value is in best agreement with electric quadrupole radiation.

A decay scheme is proposed which seems consistent with the data. Coincidence experiments, using scintillation detectors, are discussed in connection with their check on the preceding analysis.

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A PHENOMENOLOGICAL DERIVATION OF THE LAW OF β-DECAY AND THE UNIVERSAL FERMI INTERACTION

(Publication No. 5871)

Hormoz M. Mahmoud, Ph.D.
Indiana University, 1953

An empirical approach to the determination of the law of β-decay is adopted. It is demonstrated that the interpretation of the evidence already available singles out a combination of the Scalar, Tensor and Pseudoscalar forms of interaction as the correct law. The proposed law is unique in the sense that each one of the component forms is both necessary and admissible.

The analysis is based mainly on an attempt to explain the allowed shape obtained in the spectrum measurements of certain first-forbidden transitions. The theory indicates that such shapes may be observed if the Coulomb energy at the nuclear surface is much larger than the kinetic energy with which the electron and neutrino are emitted. This condition happens to be best fulfilled for just those cases in which the allowed shapes are most accurately observed. However the dominance of the Coulomb energy is a sufficient condition only for the STP or VA combinations. For the other combinations, Fierz interference terms are identified in the first-forbidden shape factor. It is shown that these terms cause deviations from the allowed shape even when the Coulomb energy is assumed to be indefinitely large.

A detailed study of Fierz effects in allowed and first-forbidden spectra leads to the exclusion of any combination of interactions exhibiting such effects. Out of the STP and VA combinations, thus found to be the only admissable alternatives, one must choose the former on the basis of the electron-neutrino angular correlation measurements on the He^6 decay.

The necessity of including each one of the component forms is established by arguments deduced from data on lifetimes, selection rules and spectrum shapes. It is well known that these data require the inclusion of both Fermi-type and Gamow-Teller type interactions. The simultaneous participation of the P form is indicated by only one piece of evidence: the Petschek-Marshak analysis of the Ra E spectrum. The arguments for and against this controversial interpretation are discussed and some new points in its support are brought forth.

The phenomenologically derived STP-law is then applied to μ-decay in order to test the hypothesis that μ - interactions should be described by the same law as β-decay. The different μ-coupling schemes, for each of which the proposed law has a different significance, are discussed. For each case the spectrum is calculated and it is shown that, with reasonable choices for the ratios of the coupling constants, agreement between experimental results and theoretical predictions can be achieved. However, the large margins of error and the contradiction between individual measurements do not allow an unambiguous conclusion.

Finally, the hypothesis of a Universal Fermi interaction is examined with a view to providing an a priori basis for the STP law. This study, although offering some criticism of previous work, is just as inconclusive.

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AN INVESTIGATION OF THE SPIN ECHO ENVELOPE MODULATION AND OF ITS RELATIONSHIP TO SPIN COUPLING AND MOLECULAR STRUCTURE

(Publication No. 5804)

Donald E. Maxwell, Ph.D.
Stanford University, 1953

A rotationally invariant type of nuclear spin coupling in molecules in liquids is investigated by means of the spin echo technique. A coupling term of the form $\hbar J\bar{I}_A \cdot \bar{I}_B$ in the Hamiltonian predicts the detailed shape of the echo envelope. The modulation frequencies of the echo envelope in their dependence on the magnitude of the coupling as well as on the chemical shift between nonequivalent protons are measured in a variety of compounds. A generalized method for calculating the spin echo is presented for large chemical shift and weak coupling among an arbitrary number of nuclei. The damping of the echo envelope, due to effects which interrupt the spin coupling, is accounted for by a phenomenological treatment of the quantum-mechanical expectation value of the nuclear magnetization.

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THE BETA SPECTRUM OF TRITIUM AND THE MASS OF THE NEUTRINO

(Publication No. 5872)

Robert James Douglas Moffat, Ph.D.
Indiana University, 1953

The energy spectrum of the beta rays from tritium has been investigated to determine the maximum beta ray energy and the exact spectral distribution in the vicinity of the end point. A large 180 degree shaped magnetic field spectrometer was employed. Precautions were taken to maintain the proper field shape and special apparatus was used to measure the low field intensity. The A line from ThC" was used for absolute calibration. The sources were 0.5 microgram/cm^2 tritiated succinic acid deposited by evaporation onto 4 microgram/cm^2 zapon supports and were

maintained at ground potential. A 1.5 microgram/cm^2 side window Geiger counter was used as detector. Small corrections were applied to the data to correct for the 0.7 percent spectrometer resolution.

The experimental data are fitted by a straight line Fermi plot from 5.5 kev to the end point of 17.95 ±0.10 kev. The absence of curvature in the vicinity of the end point indicates an upper limit of 250 volts or 0.05 percent of the electron mass for the rest mass of the neutrino. A Dirac anti-neutrino was assumed to accompany negative beta emission. The theoretical effect of non-zero neutrino rest mass on the electron spectrum is discussed. The H^3 comparative half life is determined as log ft = 3.006. An estimate of 3.50×10^{-49} erg - cm^3 is obtained for the Fermi universal constant of beta decay.

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A STUDY OF SOME NUCLEAR DISINTEGRATIONS

(Publication No. 5877)

Alan Bowen Smith, Ph.D.
Indiana University, 1953

A brief theoretical discussion applicable to nuclear spectroscopy is presented. General radiative theory, the process of beta decay, and the single particle model of the nucleus are outlined. A nuclear spectrometer of the lens type is described with emphasis on modifications leading to better performance. These modifications consist of a ring focus and spiral baffle system making full use of the electron optical nature of the instrument. With this design resolutions of better than 2% are obtainable and it is possible to differentiate between positive and negative electrons.

The experimental investigation consists of a study of the decay of Ge^{77}, Ge^{75}, Ge^{69}, Zn^{69}, Cs^{130} and a determination of the K/L ratio of the 90 Kev gamma-ray of Nd^{147}. The results of this work are summarized as follows.

A. The isomeric state Ge^{77m}(59s) is found to decay to As^{77} and Ge^{77} ground states with a 2.8 Mev beta group and a 380 Kev gamma-ray respectively. Ge^{77}(12h) decays to As^{77} with beta groups of energies 2.196, 1.379, and 0.710 Mev. Excited As^{77} returns to a stable configuration with the emission of 13 gamma-rays, the more prominent having energies of 264, 213, and 564 Kev. A decay scheme in agreement with theory and experiment is presented.

B. Ge^{69} is shown to decay by positron emission to Ga^{69}. The energies of the positron groups are 0.220, 0.610, and 1.215 Mev. The excited Ga^{69} decays to the ground state by complex gamma emission. A tentative decay scheme is presented.

C. It is determined that an isomeric state Ge^{75m}(42s) exists at an energy of 175 Kev. Further Ge^{75}(82m) is found to decay to ground and excited states of As^{75} by negatron emission of 0.614 and 1.191 Mev energy. A tentative decay scheme in agreement with the single particle model is proposed.

D. Zn^{69m}(14h) metastable state is shown to decay to Zn^{69}(56m) with the emission of a 435 Kev gamma-ray. The internal conversion coefficient is 0.053, indicating a M4 type transition. The Zn^{69}(56m) ground state goes by simple beta decay of energy 914 Kev to Ga^{69}.

E. Cs^{130}(30m) is found to decay by simple beta emission to the ground states of both Ba^{130} and Xe^{130}. The positron group to Xe^{130} has an energy of 1.97 Mev while the negatron group to Ba^{130} has an energy of 0.442 Mev. From the allowed nature of the beta transitions Cs^{130} is determined to have a spin of 1 and even parity. Using the two branches of the decay the mass differences between Xe-Ba-Cs are determined.

F. Large discrepancies exist in the measurement of the K/L ratio of the 90 Kev gamma-ray of Nd^{147}. A careful measurement of this ratio was made giving K/L/M equal to 6.88. This value indicates the transition is of the M1 type in agreement with the predictions of the single particle model.

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THE ENERGY DEPENDENCE OF THE DIFFERENTIAL SCATTERING CROSS SECTION OF ALPHA PARTICLES FROM HELIUM

(Publication No. 5879)

Frederick Edward Steigert, Ph.D.
Indiana University, 1953

The differential scattering cross section of alpha particles on helium has been investigated as a function of energy. Alpha particles from the Indiana University cyclotron were passed through a magnetic focusing and analyzing system into a scattering chamber filled with helium gas at reduced pressures. The scattered particles were detected with fifty and sixty micron Kodak NTA nuclear emulsions alternately spaced every $7\frac{1}{2}^0$ on either side of the incident beam. The range in energies was obtained by placing aluminum absorbing foils in the path of the particles prior to refocusing and analysis. Incident energies of from 21.6 mev down to 12.8 mev were used. Additional control experiments were made to check the geometry and also the assumptions made regarding secondary scattering.

The data obtained shows a very strong angular correlation. This is further a very sensitive function of the excitation energy. At the lowest energies used there is a rather singular interference between the Coulomb and nuclear interactions. This minimum, which occurs at about 55^0 center of mass angle, becomes less pronounced as one goes to higher energies. At about 10.0 mev of excitation

the cross section has become a relatively slowly varying function of the angle. Above this strong interferences begin to set in among the various angular momentum components of the nuclear portion of the interaction. This results in minima at center of mass angles of about 40^0 and 80^0. They become increasingly singular with increasing energy. The data are in essential agreement with current experiments being performed at the University of Illinois at higher energies.

These results have been analyzed in terms of the phase shifts arising from the various angular momentum components comprising the nuclear portion of the interaction. The analysis indicates two rather broad resonances at 7.55 mev and at 10.8 mev of excitation. A decomposition into a resonance fraction and a specifically nuclear fraction determines the half widths to be Γ= 1.2 mev and Γ=1.2 mev and makes state assignments of J = O^+ and J = 4^+ respectively. This interpretation is entirely consistent with results previously reported from other reactions leading to states in the Be^8 nucleus. The singular behavior of the cross section observed at low energies may explain the disagreement between the early scattering data and the Li^8 beta decay experiments. The small admixture of sixth order wave used to avoid discontinuities at the highest energies suggests that the known broad resonance at 16.9 mev may be a J = 6^+ state.

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THE RADIOACTIVE DECAY OF OSMIUM 191, IRIDIUM 192, CESIUM 134, AND TUNGSTEN 187

(Publication No. 5743)

Alonzo Edwin Stoddard, Jr.
University of Michigan, 1953

The electron spectra of osmium 191, iridium 192, cesium 134, and tungsten 187 were investigated. A double-focusing beta spectrometer of high resolution was used. Detection in the spectrometer was made with a scintillation counter or a Geiger-Mueller counter. An anthracene crystal was used in the scintillation counter, exposed directly to the evacuated spectrometer chamber. The construction and operation of the scintillation counter are presented.

The present importance of electron spectra lies in recent advancements in the methods available for their analysis. These methods are summarized. It is now frequently possible to completely specify the quantum numbers of excited nuclear states. These determinations serve to check and indicate required extensions of the nuclear 'shell-model.'

The 15 day beta decay of osmium 191 leads to two isomeric transitions in iridium 191. The energies of these transitions have been reported as 41.8 and 129.7 Kev. The 41.8 Kev transition is identified as E^2, and the 129.7 Kev transition as M^1 E^2 or M^2.

Iridium 192 decays by beta emission to platinum 192 and by K capture to osmium 192 with a half-life of 78 days. The beta decay is found to be complex with first forbidden components of 691 and 549 Kev. A lower energy component may exist. It is estimated that 97% of the decay from iridium 192 is by beta emission. Isomeric transitions of 205.7, 307.7, 316.1, 467.4, and 603.7 Kev are identified as E^2. A transition of 294.9 Kev is M^1 E^2. A decay scheme is presented in which the energy, spin, and parity of three excited states in platinum and of one excited state in osmium are given. The two beta decay components support this scheme.

The 2.3 year half-life cesium 134 decays by beta emission to barium 134. Four components were observed in the beta decay. Their energies and abundances are 657 Kev(80%), 410 Kev(6%), 210 Kev(3%), 80 Kev(10%). Comparative half-lives were computed for these transitions to be 8.8, 9.3, 8.6, and 6.8 respectively. The beta component energies and abundances support a reported decay scheme.

Tungsten 187 decays by beta emission to rhenium 187 with a half-life of 24.0 hours. Two components were observed in the beta decay with energies 1.30 Mev and 624 Kev. Both are first forbidden. The shape of the higher energy component reveals it to be first forbidden with $\Delta I = \pm 2$; yes. Isomeric transitions of 134.3, 619.2, and 686 Kev are provisionally identified as M^1 E^2. An isomeric transition of 480.0 Kev is identified as E^2. A decay scheme is presented in which the energy, spin, and parity of three excited states of rhenium 187 and the ground state of tungsten 187 are given. These states are consistent with the nuclear 'shell-model.'

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ANAEROBIC NUTRITION OF SACCHAROMYCES CEREVISIAE

(Publication No. 5852)

Arthur Albinus Andreasen, Ph.D.
Indiana University, 1953

The yeast S. cerevisiae has not been successfully subcultured anaerobically in the chemically defined media devised heretofore. Subcultivation was possible, however, in media containing certain crude materials. This indicated that growth under anaerobic conditions is a nutritional problem. The objective of this investigation was to determine what compounds are essential for anaerobic growth.

The most significant result obtained was the discovery that anaerobic growth does not occur unless both an unsaturated fatty acid and a sterol are present in the medium. Free oleic acid and ergosterol, in solubilized form, were used routinely, although other unsaturated fatty acids and some other sterols were also found to be active. The defined basal medium consisted of trace elements, salts, ammonium sulfate, glucose, buffer and five vitamins. Magnesium and the four vitamins biotin, pantothenate, nicotinamide and thiamin were found to be indispensable for anaerobic growth. Pyridoxine augmented growth. Under aerobic conditions, none of these vitamins, with the possible exception of biotin, was indispensable, although all five of the above vitamins, and inositol, were necessary for maximal growth.

The anaerobic lipid requirements, determined under conditions where only one of the lipids was the limiting growth factor in the medium, were found to be ca 84 uu moles ergosterol per million cells and 355 uu moles oleic acid per million cells. This is compared with an approximate nicotinamide requirement of 20 uu moles per million cells. The unsaturated fatty acids are believed to have a structural role while ergosterol appears to have an enzyme-linked role. It was proposed that these lipids are required due to failure of anaerobic biosynthesis.

Although rather large populations (170-275 million cells/ml) were obtained in the defined lipid medium, it was possible to attain larger populations (over 500 million cells per ml) by the addition of an unidentified growth factor(s) present in certain tissue extracts and tissue digests. These crude materials did not promote growth in defined oleic acid media unless ergosterol was also present. On the other hand, aerobic growth (400-500 million cells per ml) was not benefited in the presence of either the essential lipids or the crude material containing the unidentified factor. Since an extract of yeast grown aerobically also had unidentified factor activity, it appeared that the factor is synthesized in adequate amounts by aerobic cells. It was proposed that the factor is synthesized to a limited extent anaerobically, the amount formed governing the magnitude of anaerobic growth. The anaerobic biosynthesis as well as the anaerobic growth promoting activity of the factor are thought to be dependent upon the presence of ergosterol.

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A STUDY OF THE ACTION OF HEPARIN ON PROTOPLASM

(Publication No. 5578)

Alfred B. Chaet, Ph.D.
University of Pennsylvania, 1953

Supervisor: L V. Heilbrunn

Perfusion experiments on in vitro frog heart preparations show that dilute solutions of heparin stop the frog heart in diastole. When heart preparations are continuously perfused with solutions of heparin, the heart begins to beat again within approximately three minutes. If the heart is then perfused with heparin-free Ringer's solution, it becomes sensitive to heparin again. The heparin, as it is pumped through the chambers of the frog heart, is not inactivated. Protamine sulfate added to heparin solution prior to its perfusion destroys the inhibitory action of heparin on the frog heart.

By dialysis experiments, it was shown that a relatively small molecule present in heparin samples is responsible for the inhibitory effect on the frog heart. This small, dialyzable molecule has been detected in three, separate, commercially prepared heparin samples. The dialyzable (or active) substance present in heparin samples inhibits cell division of the eggs of the clam, Spisula solidissima. The activity of this dialyzable substance on the frog heart and cleavage of Spisula eggs is lost after the substance has been allowed to remain at room temperature for several days, whereas the activity is still present in samples frozen for the same period. Cell division, in the eggs of the starfish, Asterias forbesii, as well as in those of the sea urchin, Arbacia punctulata, has also been shown to be inhibited by the active substance present in heparin solutions, but the susceptibility of Arbacia eggs is less than those of Spisula and Asterias eggs.

Although the addition of toluidine blue solutions to heparin dialyzates does not produce an immediate metachromatic reaction, dialyzates allowed to remain in the presence of toluidine blue for 12-24 hours do develop a metachromatic precipitate. The metachromasia of the precipitate obtained from dialyzed heparin solutions is lost upon the addition of protamine sulfate solutions. The concentration of protamine

sulfate necessary to destroy this metachromasia is approximately equal to that necessary to destroy the metachromasia of precipitates of heparin and toluidine blue. A comparison was made of the effect of various solvents in causing loss of metachromasia in precipitates of the active (dialyzable) substance and toluidine blue and of heparin and toluidine blue. The loss of metachromasia was found to be similar in both cases.

It is suggested that the dialyzable fraction of heparin, as obtained in the active dialyzates, is a heparin-like substance and that its loss of biological activity may possibly be due to the polymerization of the small molecules into larger ones. This polymerization occurs only when the active substance has been separated from the non-dialyzable molecule. A comparison of the ultraviolet spectrum of the dialyzate from heparin solutions and the ultraviolet spectrum of the heparin solution remaining in the dialysis sac showed that the two spectra are similar. Even after prolonged dialysis, a substance absorbing ultraviolet light continues to pass through the dialysis sac.

In addition to the small, readily dialyzable molecule there is evidence that there is present another larger molecule which may pass through the dialysis sac under certain conditions. This larger molecule has anticoagulant activity when tested on blood clotting. Also it contains hexosamine, whereas the smaller molecule appears to be lacking in hexosamine.

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PHYSIOLOGICAL STUDIES OF THE VENOUS SYSTEM

(Publication No. 5534)

Francis John Haddy, Ph.D.
University of Minnesota, 1953

Methods are described for measurement of pressures in small veins and arteries (0.5 mm.) of dogs under local and general anesthesia.

Normal values for foreleg subcutaneous small vein pressure averaged 13.1 mm. Hg, while large vein (cephalic) pressures were 7.1 mm. Hg under local anesthesia and 14.6 and 4.2 mm. Hg respectively under nembutal anesthesia. Normal values for foot pad small artery pressure averaged 65 mm. Hg as compared to 123 mm. Hg for systemic arterial pressure (femoral or brachial) in dogs under general anesthesia.

A significant correlation was not demonstrated between either mean small and large vein pressures or between small vein and systemic arterial pressures in dogs under general anesthesia. Under local anesthesia, large spontaneous fluctuations occurred in small vein pressure, not associated with significant changes in large vein pressure. The findings suggest that small vein pressures may be independently controlled possibly by a kind of sphinctor mechanism somewhere between the small and large veins.

Intra-arterial injection of commercial epinephrine, 1-epinephrine and 1-norepinephrine in doses of 0.5 to 5.0 μg elevated small vein pressure without a significant change in large vein pressure, elevated small artery pressure and decreased brachial artery blood flow. The findings are interpreted as being due to active small vein constriction proportionately greater in the small veins than arterioles. Ferritin and apoferritin failed to quantitatively alter the small vein pressure response to epinephrine in either the foreleg or mesentery although qualitative changes in pressure curve contour were noted in two of six experiments.

Intra-arterial injection of serotonin elevated skin small vein pressure, decreased muscle small vein pressure and decreased foot pad small artery pressure. Brachial artery blood flow increased slightly with small doses and decreased considerably with large doses. The results suggest a different mode of action of serotonin on skin and muscle small vessels.

Intra-arterial injection of histamine caused a small elevation in skin small vein pressure, a large elevation of muscle small vein pressure, a decrease in small artery pressure and an increase in brachial artery blood flow. The elevation in small vein pressure is interpreted as being passive due to increased blood flow subsequent to arteriolar dilatation. The effects of other familiar chemical substances on small vessel pressures are also described.

Exercise caused a large elevation in small vein pressure and a small elevation in large vein pressure. The results are interpreted as being passive due to increased blood flow.

Small vein pressure was observed to be elevated above the expected colloid osmotic pressure of plasma in four dogs with limb edema due to arteriovenous fistulae. The small vein to large vein pressure gradient was also elevated.

Dogs with elevated right ventricular pressure but with normal right atrial pressures due to pulmonary stenosis exhibited a borderline elevation of small vein pressure and of the small vein to large vein pressure gradient in the presence of normal large vein pressures. Dogs with elevated right ventricular and right atrial pressures due to pulmonary stenosis and tricuspid insufficiency also were observed to have a borderline elevation in small to large vein pressure gradient with a normal large vein pressure. Both groups also appeared to have an increase in the fluctuant nature of the small vein pressure.

Two dogs with peripheral edema due to heart failure had elevated small and large vein pressures. The small to large vein pressure gradient was observed to be decreased, normal or elevated at various times.

Mechanical distention of the vena cavae, the right atrium and a branch of the pulmonary artery had little effect upon the small to large vein pressure gradient.

Hemmorrhagic shock caused a marked decrease

in foreleg small vein pressure with little change in mesenteric small vein pressure.

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A STUDY OF MESONEPHRIC TUBULAR TRANSPORT OF ELECTROLYTE

(Publication No. 5538)

Tom Hoshiko, Ph.D.
University of Minnesota, 1953

1. The doubly perfused frog kidney provides an adequate method for demonstrating tubular excretion. Negligible amounts of inulin placed in the portal perfusion fluid appear in the urine. The urine produced is distinctly hypotonic and water reabsorption is maintained.

2. It is shown that the isotopes Na^{22} and K^{42} when perfused via the renal portal vein alone, appear in the urine considerably in excess of that explicable as glomerular filtration. This tubular excretory movement of sodium and potassium can occur in the face of a net reabsorptive movement.

3. If the renal vein outflow can be taken to be representative of the peritubular fluid, the descending order of approach to equilibrium between the urine and peritubular fluids proceeds in general from water to potassium to sodium.

4. Arterial perfusion of sodium cyanide (2mM/L) was shown to be effective in halting net reabsorption of water, sodium, and potassium. However, the tubular excretion of the isotopes D_2O, Na^{22}, and K^{42} continued despite the cyanide perfusion. Calculation of the unidirectional flux for water, sodium, and potassium indicated that the decreased net reabsorption of each was due more to a decreased unidirectional reabsorption than to an increased unidirectional tubular excretion.

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THE INFLUENCE OF EXERCISE, EMOTIONAL STRESS, STARVATION, AND AGE ON STATIC NEUROMUSCULAR TREMOR MAGNITUDE

(Publication No. 5485)

John C. Mitchem, Ph.D.
State University of Iowa, 1953

The purpose of this study was to show the effects of exercises of graded intensities, emotional stress, starvation, and age on neuromuscular tremor magnitude.

Neuromuscular tremor was recorded by an electronic device which provided records from which neuromuscular tremor magnitude was calculated. Neuromuscular tremor magnitude was expressed as a combination of neuromuscular tremor rate and amplitude. This combined expression was found by measuring the area under a tremor curve of one second duration. The area measured was bounded by ordinates placed one second apart, the tremor curve, and lines connecting the tremor troughs.

A summary of the findings resulting from the study follow:

1. Data were collected from three groups of thirty subjects each to show the effect of bouts of exercises of graded intensities which consisted of arm curls, knee-bends and bicycle riding, on neuromuscular tremor magnitude. The following conclusions were based on the means of the data collected:

   a. The neuromuscular tremor magnitude varied directly with the intensity of all types of exercises studied.

   b. There was a coefficient of correlation of 0.043 between the maximum amount of work that the subjects accomplished, riding the bicycle ergometer and the neuromuscular tremor magnitude following the ride; thus it was concluded that these factors were not related.

2. The effect of emotional stress was studied by comparing the neuromuscular tremor magnitude of fifteen students which was recorded under the non-stress situation of regular laboratory work with neuromuscular tremor magnitude resulting from the anticipation of a written examination. The data show that the emotional stress caused by the anticipated examination resulted in a neuromuscular tremor magnitude that was significantly greater than that exhibited under normal class situations.

3. Data collected from six subjects after abstinence from food for seventy-two hours show that the neuromuscular tremor magnitude as compared with the resting normal was significantly greater after the period of starvation. Furthermore, it was found that 1250 kgm. work in one minute, after starvation increased the neuromuscular tremor magnitude 2.93 times more than it did under normal dietary circumstances.

4. The neuromuscular tremor magnitude of a group of twenty-six school boys twelve to fourteen years of age was compared with the neuromuscular tremor magnitude of a group of ten men sixty to eighty-three years of age. The data show that the neuromuscular tremor magnitude of the older group was significantly greater than that of the younger group.

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THE EFFECTS OF GRADED CALORIC RESTRICTION UPON CERTAIN ENDOCRINE AND TARGET ORGANS IN RELATION TO MOUSE MAMMARY CARCINOMA

(Publication No. 5571)

Truman Albert Newberry, Ph.D.
University of Minnesota, 1953

A study was made of the effects of graded caloric restriction upon certain endocrine and target organs and on the incidence of carcinoma of the breast in virgin females of the C_3H stock of mice. This study was carried out to determine what type of function the incidence of this type of tumor was with respect to various degrees of caloric restriction. The experiments were also planned to secure data on the frequency of hyperplastic nodules and the degree of lateral budding in the breasts, and other criteria of the amount of estrogenic stimulation to which these animals were subjected. Such data would be useful in determining the mechanisms responsible for the decrease in the incidence of carcinoma of the breast noted when caloric restriction of a sufficient degree is instituted.

As caloric restriction was imposed in graded steps of increasing severity it was noted that the incidence of carcinoma of the breast, the number of positive vaginal smears, the number of hyperplastic nodules and the degree of lateral bud development in the breast, and the mean ovarian weight all maintained a fairly high level in the animals ingesting 9 or more Calories per day, while all quantities declined in the animals allowed only 8 Calories per day. These findings are in agreement with the hypothesis of Huseby, Ball and Visscher (1945) that the decrease in mammary carcinoma in the presence of caloric restriction can be explained on the basis of an hormonal inadequacy.

In view of the established fact that the thymus atrophies in many animals in the face of severe malnutrition, it is of interest to note that the weight of the thymus gland was not markedly affected by the 1/3rd restriction of caloric intake maintained over long periods in the animals studied here.

The mean weights of the submaxillary, the sublingual, and the adrenal glands, and the heart, spleen, pancreas and liver in general all showed a gradual decrease in weight as the level of caloric intake was decreased. The kidney and spleen weights remained quite level in animals on 9 or more Calories per day and dropped noticeably in the animals allowed only 8 Calories per day.

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AN ELECTRICAL STUDY OF MOTOR NEURON FUNCTION

(Publication No. 5711)

Lloyd Donald Partridge, Ph.D.
University of Michigan, 1953

Ventral root potentials were recorded from isolate frog cords, employing the method of Barron and Matthews, and their significance in reflex function was examined.

It was determined that the ventral root potential could be expected to record, with accuracy, the time course of a process occurring in the cord, and that in view of its high temperature coefficient this process apparently involves a chemical reaction. The exponential form of the decay and the characteristics of the summation of the ventral root potential following repetative stimulation was found compatible with the theoretical summation of an electrochemically active neurohumor such as acetyl choline.

Changes with temperature support the theory that a centrogenic metabolic excitation of the neuron sums with the reflex excitation in determining the intensity of response. Furthermore a relatively prolonged action of the reflex component of excitation of the individual neuron best explains the relationships between ventral root potential and reflex spike responses. It was shown that the accommodation of the neuron to this reflex excitatory process might be similar to the accommodation demonstrated by Skoglund in the neuraxon.

The action of a prolonged excitatory process at the individual synaptic junction would make possible a mechanism whereby a short chain of neurons could be responsible for the long reflex delays seen with weak stimuli. Stronger stimulus not only shortened this delay but often produced a complex ventral root potential which appeared to be merely the effect of the interaction of two or more simple ventral root potential producing processes.

The depressed reflex action produced by reflex fatigue was found to be accompanied by, and presumably due to depression of the ventral root potential producing mechanism.

Failure to disrupt reflex integration when conduction timing was altered was taken as an indication that interference of brief acting processes is probably not the normal basis for reflex inhibition.

A response dependent on the interaction of metabolic excitation, reflex neurohumoral release and removal, and accommodation would take on different characteristics depending on intensity and rate of change of any and all of these factors. Thus, it is possible, that to a great extent, the differences in reflex characteristics displayed under different conditions or in different reflex systems represent quantitative differences of factors in the function of individual neurons rather than representing action of qualitatively different complex networks of neurons with each neuron operating in a constant inflexable manner.

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NEUROHISTOLOGICAL BASIS FOR THE FUNCTIONING OF PAIRED HALF-CENTERS

(Publication No. 5719)

Ernest Walter Retzlaff, Ph.D.
University of Michigan, 1953

Neurohistological studies were made of the central nervous system of cold- and warm-blooded animals to determine the existence of structures postulated for the functioning of paired half-centers.

It was found that fixation of tissue by immersion or by perfusion did not satisfactorily preserve minute neuronal structures, such as axon collaterals and their synaptic endings, in sufficient numbers required for this study. A freeze-dehydration apparatus and method developed in this laboratory gave excellent preservation of these structures and proved highly suitable for this investigation. The tissues were serial-sectioned and stained by the protargol method.

According to the concept of polar function of the neuron, the dendrites and cell body constitute the excitatory pole and the axon hillock region the inhibitory pole. The high metabolic activity of the dendrites and cell body creates a neurocellular potential which causes current to flow internally from the dendrites to axon hillock, and externally from axon hillock to dendrites. Synaptic negativity superimposed on the excitatory pole increases the neurocellular potential; synaptic negativity at the inhibitory pole decreases it.

The VIIIth nerve root fibers in the fish were found to end mainly on the dendritic (excitatory) pole of the homolateral Mauthner's cell and on the axonic (inhibitory) pole of the contralateral Mauthner's cell. Such distribution of synaptic endings, functioning in a postulated polar manner, would produce simultaneous reflex excitation of the homolateral cell, and reflex inhibition of the contralateral cell.

The postulated role of the re-enforcing, recruiting, and the inhibitory collaterals is to mediate and to integrate the activity of the neurons in the central nervous system. The re-enforcing collaterals originating from the axon end on the perikaryon or dendrites of the same cell. They are assumed to function as a mechanism for maintenance of, or for acceleration of, the neuronal discharge. Collaterals of this type were found on Müller's and reticular cells of the fish and on Purkinje cells of the dog and the cat. Recruiting collaterals arising from the axon of one cell end on the dendrites or perikaryon of a second cell, and in the same manner extend between the second and a third cell. Their proposed function is the recruitment of a series of neurons of similar function into a slowly augmenting type of response. This type of collateral was found between Purkinje cells and the pyramidal cells of the dog.

Inhibitory collaterals passing from the axon of one cell end on or near the axon hillock of a like cell. Their postulated role is the coordination of pairs of neurons, or half-centers, so that while one cell is discharging it reciprocally inhibits the discharge of a similar but functionally antagonistic neuron, thus producing an alternating discharge of these half-center cells. Inhibitory collaterals were seen in relation to pyramidal cells of the dog, Purkinje cells of the dog and the cat, and reticular cells of the fish.

These observations support the concepts of polar function of the neuron, the mediation and integration of neuronal activity by axon collaterals, and the organization of the central nervous system into neuron pairs, or half-centers.

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STUDIES ON THYROID FUNCTION IN ANURAN TADPOLES

(Publication No. 5880)

Charles Henry Steinmetz, Ph.D.
Indiana University, 1953

The thyroid function of anuran larvae (Rana clamitans and Rana pipiens) before metamorphosis has been studied in experiments involving treatment with thyroxine and the antithyroid compounds thiourea and 2-thiouracil. Measurements of live body weight indicate that treatment with 0.03% solutions of these antithyroid compounds causes the treated larvae to grow more rapidly than the controls. The increase in body weight of the treated larvae is accompanied by increases in the dry weight, nitrogen content, fat content, oxygen consumption and gonad lengths. The rate of premetamorphic morphological differentiation is apparently unaffected. Treatment with adequate dosages of thyroxine produces opposite effects, that is, the animals grow less rapidly. Simultaneous administration of adequate thyroxine with the antithyroid compounds reverses the effects of the latter. These results can be obtained a few weeks after hatching and, in species with a long larval life, several months before metamorphosis normally occurs. It is concluded from these data that the thyroid gland of anuran tadpoles begins to function early in ontogeny and is essential for normal growth.

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AN INFRARED ANALYZER FOR CARBON DIOXIDE AND ITS APPLICATION TO CERTAIN PROBLEMS IN RESPIRATORY PHYSIOLOGY

(Publication No. 5561)

Richard Wolcott Stow, Ph.D.
University of Minnesota, 1953

In studying the dynamics of external respiration a method was needed for more rapid automatic analysis of expired air. The absorption of infrared radiation by carbon dioxide was used as the basic principle in the analyzer which was developed. Pure carbon dioxide served as the primary detecting agent in the measurement of absorption thus achieving considerable inherent selectivity. The infrared source was housed in an evacuated chamber thus simplifying the optical design and enhancing the stability of the emission of the source. Use was made of the double beam principle and conventional electrical amplification of the signal permitted direct recording.

The volume of the absorption cell was approximately 0.1 ml. When a sample delivery tube 80 cm. long and 0.1 cm. internal diameter was used, a sampling rate of 300 ml/min. was sufficient to achieve an overall response of 99% to a sudden change in sample composition in about 0.4 seconds. The instrument was calibrated by observing the response to mixtures which had been analyzed by the Haldane chemical method.

Upon comparison of the results of instrumental and chemical methods of analysis, a systemic error was observed in the infrared measurements. The error was shown to arise from the dependence of the intensity of absorption by carbon dioxide on the other gases in the mixtures. Circumstantial evidence was obtained which indicated that, in addition, the spectral position of the absorption by CO_2 depends on the molecular constitution of the other gases present.

When the gases other than CO_2 in the calibrating mixtures were present in approximately the same proportions as in the unknown samples of expired air, the average difference in the analysis by instrumental and chemical methods was 0.04 per cent by volume.

Physiological Applications

An experimental study was made of certain effects of a brief period of voluntary hyperventilation in 32 normal humans. The chief findings were:

1. The return of the end-tidal pCO_2 to the resting level was virtually complete within ten minutes after the end of the two minutes hyperventilation.
2. In nearly every case the regular decline of the end-tidal pCO_2 with the onset of hyperventilation was halted or reversed at about the fourth supra-normal tidal exchange. Changes in the estimated alveolar ventilation during this period did not explain the finding.
3. In a few cases stepwise increases were noticed in the pCO_2 of expired air in which the steps were synchronous with the beat of the heart.
4. There was considerable variation in the individual response to hyperventilation.

By analyzing expired air from a series of classical alveolar expirations performed at four phases of the respiratory cycle, data was obtained to show the expected variation in alveolar pCO_2 throughout the cycle.

A respiratory maneuver was suggested which might produce an analyzable sample of expired air having the pCO_2 of mixed venous blood. Data resulting from this procedure were presented which tend to encourage further investigation.

Following a sudden disturbance in the composition of alveolar gas, the course of the recovery to the normal level of carbon dioxide was observed by continuously recording the pCO_2 of expired air in subsequent exhalations. The theory of the composition of alveolar gas of DuBois and others was extended in an attempt to interpret the experimental results.

The normal breath to breath fluctuations in the end-tidal pCO_2 of resting subjects were studied by continuous analysis of expired air for several minutes. The standard deviation of the fluctuations is about 0.4 to 0.5 mm. Hg. Under these circumstances the end-tidal pCO_2 fluctuates in an aharmonic manner. An attempt was made to correlate these changes with alterations in other physiologic variables associated with respiration.

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RELATIVE CONTRIBUTION OF THE GLOMERULUS AND RENAL TUBULE TO THE URINARY WATER IN THE ISOLATED DOUBLY-PERFUSED BULLFROG KIDNEY

(Publication No. 5563)

Robert E. Swanson, Ph.D.
University of Minnesota, 1953

We have utilized the isolated doubly-perfused bullfrog kidney in studies designed to separate glomerular and tubular contributions to the urinary water. This preparation takes advantage of the anatomy of the vascular supply of the glomerulus and tubules: the renal artery supplies blood to the glomerulus and thence to the tubules via the efferent arteriole, the portal vein supplies blood to the tubules only. Except for small amounts that may gain access to the glomerulus by retrograde movement via the efferent arteriole, substances incorporated into the fluid used to perfuse the portal system presumably gain access to the urine by passive or active transfer across the tubule

wall. Amounts of portal vein fluid filtered at the glomerulus may be inferred from the amounts of inulin (which is incorporated into the portal fluid only) appearing in the urine if it is assumed that inulin gains access to the urine by glomerular filtration only.

When creatinine and inulin are both incorporated into the fluid used to perfuse the arterial system, the creatinine and inulin clearances are identical within the limits of accuracy of measurement. Therefore the sum of the creatinine and inulin clearances (when these substances are incorporated into the renal artery and portal fluids respectively) has been used to estimate the rate of glomerular filtration. It has been found however, that when creatinine is incorporated into the portal fluid only, the creatinine clearance is significantly greater than the inulin clearance. Explanation in terms of possible creatinine secretion by the tubules has been considered and some experimental confirmation has been presented.

The conclusion that water can gain access to the urine by passage through some portion of the tubule wall from the peritubular capillaries has been drawn from the results of three types of experiments:

(1) Deuterium oxide when incorporated into the portal fluid appears in the urine in amounts over 100 times greater than can be accounted for on the basis of glomerular filtration alone.

(2) The urinary D_2O concentration is less than the glomerular filtrate concentration when deuterium oxide is incorporated into the arterial fluid only.

(3) When fluids of higher osmotic pressure than the peritubular capillary fluids are filtered (mannitol incorporated into the arterial fluid only), the rate of urine flow is greater than the rate of glomerular filtration.

These experimental results have been interpreted in terms of currently accepted theories of water reabsorption by the renal tubule: the proximal tubule, which is the site of passive reabsorption of water, is probably permeable to water in both directions and the distal tubule, which is the site of formation of hypotonic urine in submammalian classes, probably retards the free movement of water in at least the reabsorptive direction.

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THE MECHANISMS OF REACTIVITY AND SUPERSENSITIVITY OF NORMAL AND DENERVATED VASCULAR STRUCTURES TOWARD HUMORAL TRANSMITTERS

(Publication No. 5884)

Mary Purcell Wiedeman, Ph.D.
Indiana University, 1953

Studies were directed toward determining the behavior of minute blood vessels in peripheral vascular beds in innervated and denervated areas. For this purpose the wing membrane of the living bat was used, and responses of smooth muscle cells to topical applications and intravenous injections of epinephrine were observed at high magnification (1200X).

Epinephrine was applied topically to an exposed vascular area to determine the weakest concentration needed to elicit complete closure of an arteriole or terminal arteriole by constriction of encircling smooth muscle cells, and this end-point was designated as the apparent threshold response.

Apparent thresholds were determined in normal wings and found to vary over a wide range. This confirms experimental data obtained in other vascular beds (Wiedeman and Nicoll, 1953)[1] and reemphasizes the necessity of careful interpretation of data from any method using a change in effective concentration of a chemical agent as a criterion of a fundamental modification in response of an effector system.

Intravenous injections of epinephrine showed that increased responsiveness of arteriolar vessels developed in a denervated wing 10 to 14 days following section of the nerve. This indicates that the minute vessels of the bat wing conform to the behavior of similar structures in other animals under the same conditions.

Comparisons of responsiveness to topical applications of epinephrine were made between vessels in denervated and innervated areas in the same animal. No increased responsiveness could be demonstrated in minute vessels of denervated areas when the responsiveness was compared to identical areas in the contralateral innervated wing.

The finding that there was no difference in responsiveness between denervated and innervated vascular areas when a chemical excitor was applied directly to the reactive cell implies that no alteration, such as in increased permeability of the cellular membrane or supersensitivity of the cell, could account for the increased responsiveness to intravenous epinephrine following denervation.

Various other factors that may contribute to change the relationship between the cell and its environment are discussed.

It was concluded that no single factor could be responsible for the increased responsiveness of denervated vascular beds to blood-borne effective agents, and that such an increased responsiveness is the result of changes in the cell-environment equilibrium and not an alteration in intracellular conditions alone.

1. Wiedeman, M. P. and P. A. Nicoll. Variations in Response of Minute Vessels in the Cecal Mesentery of the Rat to Topically Applied Epinephrine. Am. J. Physiol. 172:187-194, 1953.

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POLITICAL SCIENCE, GENERAL

THE BRANNAN PLAN: A STUDY IN POLICY-FORMULATING AND OPINION-INFLUENCING ACTIVITIES OF THE U.S. DEPARTMENT OF AGRICULTURE

(Publication No. 5650)

Reo Millard Christenson, Ph.D.
University of Michigan, 1953

This thesis represents an inter-discipline case study of the policy-formulating and opinion-influencing activities of the U.S. Department of Agriculture in connection with former Secretary of Agriculture Charles F. Brannan's controversial farm plan. A discussion of the economic and political background of the plan precedes a detailed description of the decision-making process within the Department which culminated in the "Brannan Plan." The influence of the National Farmers Union upon the Department is explored at some length.

An economic analysis of the Secretary's proposals is followed by a fairly exhaustive treatment of the Department's informational and publicity activities relating to the Plan. Printed matter issued by the Department from April 7, 1949 to November, 1950 is quantitatively appraised in order to determine the extent of Departmental efforts to present its case to the public.

The political downfall of Brannan's program is analyzed, with special attention given to the Department's relations with the American Farm Bureau Federation. A final chapter offers suggestions concerning the appropriate role of a government department in the making of national policy and in the influencing of public opinion in a desired direction.

Considerable information was obtained by interviews with U.S. Department of Agriculture officials in Washington, with members of Congress, and with officers of various agricultural and other private organizations. Questionnaires were extensively employed in obtaining data on the informational activities of the Production and Marketing Administration and the Extension Service. Access was also had to the files of the Department.

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SOME ASPECTS OF THE POLITICAL BEHAVIOR OF LABOR UNION MEMBERS IN THE DETROIT METROPOLITAN AREA

(Publication No. 5663)

Richard Woodbury Dodge, Ph.D.
University of Michigan, 1953

This study is concerned with an analysis of the political behavior of labor union members and other persons in union families, as compared with the non-union portion of the population, plus an investigation of differences between CIO members and those in non-CIO unions.

The data upon which this study was based were collected by means of interviews with a representative cross-section of the adult population residing in the Detroit Metropolitan Area, through the facilities of the Detroit Area Study of the University of Michigan in the course of a larger investigation of participation in community affairs.

In the area of political activity, an index was constructed, combining voting in three elections with three other ways of participating politically. It was discovered that union members participated to as great an extent as did non-union members, although the predominantly male composition of the union member group contributed to this result, while wives of union members were much less politically active.

The measure of political affiliation was based on a combination of the respondent's own classification of his party preference, plus what he reported as his vote in two elections. Approximately 80% of the people in union families, who indicated a political preference, favored the Democratic Party, while the non-union segment had only a slight Democratic majority. CIO members tended to be proportionally more Democratic than AFL and Independent union members.

The pattern of political affiliation in a nonpartisan election was studied in terms of votes cast for Mayor of Detroit in 1951. The two union groups were more favorable to the candidate supported by organized labor than were non-union members, although this support was far below that usually accorded by labor to candidates of the Democratic Party. CIO members furnished proportionally more of the votes received by labor's candidate than did other union members.

The three issues of domestic policy involved attitudes toward National Health Insurance, price control, and measures generally associated with the Fair Deal. The degree to which an individual supported the pro-Democratic/pro-union position on these issues apparently depended more on party affiliation and a pro-union orientation than on any connection with unions. The two union groups were more

favorable to the union position on these issues than was the non-union group, although a majority of the latter favored price control and the Fair Deal.

Three general conclusions may be mentioned. 1) Political affiliation emerged as the variable which most sharply discriminated between persons in union families and non-union members. 2) Despite an absence of party labels, a distinct pattern of political affiliation was observed in the nonpartisan election. 3) Since those union members who exhibited a more pro-union orientation tended to display greater political activity, proportionally more support for the Democratic Party, and a greater degree of approval of issues favored by organized labor, it suggests that labor may have some impact on the political behavior of at least a portion of its membership.

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THE DEVELOPMENT OF POLITICAL DEMOCRACY IN PUERTO RICO

(Publication No. 5546)

William McIntosh, Ph.D.
University of Minnesota, 1953

The purpose of this study is to examine, evaluate, explain, and present the available information on the development of political democracy in Puerto Rico. Political democracy, as interpreted by the writer, means self-government, plus that type of government which is carried on by the people, for the people, and is of the people.

The data used in the preparation of this study were derived from (1) extensive research and travel throughout Puerto Rico, (2) personal interviews with various citizens and governmental officials in Puerto Rico, (3) access to documents of the Insular and Federal Governments, (4) available reference materials at the Library of Congress, libraries of the University of Minnesota and the University of Puerto Rico, Carnegie Library of San Juan, Puerto Rico, and the public libraries of St. Paul and Minneapolis, Minnesota, and (5) newspaper articles, periodicals, and pamphlets.

The struggle for political democracy in Puerto Rico has been exceedingly difficult. This study shows that Puerto Rico was denied anything resembling political democracy for almost four hundred years under Spanish rule. The absolute powers of the governor, a restricted economic system, limited educational opportunities, and poor sanitation forced many Puerto Ricans to live in poverty and ignorance, and to be deprived of any training in the art of self-government.

With the coming of the Americans in 1898 rapid progress was made. A consistent policy of granting Puerto Rico more self-government was pursued by the administration in Washington. After nineteen years of training in self-government the Insular Legislature was placed in the hands of the Puerto Ricans. Thirty years later the Governor became popularly elected; and in 1952 the third branch of government, that of the judiciary, became locally appointed.

By Public Law 600 of 1950 the Puerto Ricans were permitted, with certain limitations, to form their own Constitution. In 1952, keeping within these limitations, a Puerto Rican Constitutional Convention drew up a fundamental law which was accepted by the people of Puerto Rico in a referendum, and also by the Congress and President of the United States. On July 25, 1952, this Constitution became effective and Puerto Rico was elevated to a new political status, that of a Commonwealth. The island is neither a state of the Union, a dominion nor a sovereign state. Insular affairs are controlled by the Insular Government while such measures as foreign policy and defense are controlled from Washington. Congress and the President have lost their power to veto insular legislation. Puerto Rico's present position rests between that of a colony, where internal and external policies are controlled by the imperial power, and that of a dominion, where such policies are conducted by the local government.

The general conclusions are that (1) political democracy does exist in Puerto Rico, though of recent origin; (2) the grass roots of political democracy in Puerto Rico are found in local institutions which have for the first time been treated here at some length; (3) the Puerto Ricans realize that democracy does not function in a vacuum and that economic and social problems must be considered; (4) considerable progress has been made in the political, economic, and social fields through Puerto Rican initiative characterized by "Operation Bootstrap"; (5) Puerto Rico could not adequately thrive without the American market and aid designated as "Operation Boost"; (6) the commonwealth status was mutually agreed upon by the two governments and is the first of its kind in the American system of government; and (7) the commonwealth status might serve as a guide to other imperial-colony relationships in international relations where the desire for self-determination is causing disorder.

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A STUDY OF THE RELATIONSHIP OF POLITICAL BEHAVIOR TO SOCIAL GROUP MEMBERSHIP

(Publication No. 5700)

Robert Owen McWilliams, Ph.D.
University of Michigan, 1953

The purpose of this study was to investigate three aspects of the problem of the relationship between

social group membership and political behavior: (1) the effect of membership in groups that differ in degree of "politive political orientation" (defined as the extent to which the group qua group takes an active, positive interest in political matters) on one's own political attitudes and behaviors; (2) the nature of the relationship between the individual's level of social group participation and the level of his political interest and participation; and (3) the correlates of the ability successfully to judge the political complexion of groups belonged to.

Five social organizations that observation revealed to vary from high to low on a positive political orientation continuum and to differ in regard to major purpose and socio-economic composition were chosen from the same community for investigation. Members were asked to complete a questionnaire that contained items that attempted to measure certain demographic and personality characteristics, a variety of political attitudes and behaviors, and extent of social group participation.

The following is a summary of the more important findings of this study: (1) There is a direct relationship between group position on the positive political orientation continuum and the political behavior of its members. The members of the only clearly positively politically-oriented group were found to be possessed of a greater sense of political obligation and of political efficacy and were, on the whole, more interested in political matters and more active politically than the members of the other groups. (2) Whether a person conforms to the demands of his group seems quite definitely to depend upon the extent of his involvement in that group. In the most positively politically-oriented group the active members were much more likely to have a highly developed sense of political responsibility and efficacy and to be politically active than the inactive members, whereas these consistently significant differences were not found in the other groups. (3) Level of political participation and interest is positively related to sense of political responsibility and efficacy. (4) There is a substantial, positive relationship between level of formal social group participation and level of political participation and interest, and this holds true even when a number of variables (demographic, personality and attitudinal) that are related both to social group participation and to political participation are held constant. Only at the higher socio-economic levels does this appear not to be the case. (5) Of the four factors thought to be related to success in judging the political complexion of groups (degree of group involvement, level of political activity and interest, level of social group participation, and education), only education showed any appreciable relationship. (6) There is a marked tendency for individuals to see the other members of their group as like themselves in political and socio-economic attitudes, in political affiliation, and in level of political interest and participation. This tendency, which we have called "projection," is probably related to degree of interest in the matter being judged.

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THE JUSTICE OF THE PEACE IN CALIFORNIA

(Publication No. 5806)

Paul R. Murray, Ph.D.
Stanford University, 1953

In California's early gold-rush days the office of justice of the peace was one of authority and prestige. Changing conditions, creation of new inferior courts, complication and confusion of the whole lower court system led in 1950 to the adoption of a reorganization of those courts. This action eliminated the justice of the peace but left the essential features of his office in the new justice courts.

Before this reform California had nearly 800 inferior courts of six distinct types – two kinds of municipal courts, city courts, police courts, city justices' courts and township justices' courts, the latter divided into two classes. Two or more courts often served the same area. The new system provides two kinds of courts, municipal courts in districts with population in excess of 40,000 and justice courts in less populous areas.

Judicial townships, each with at least one justice of the peace, formerly blanketed the state. Generally township boundaries had been drawn to make the courts readily accessible to the people. As a consequence, most townships had too few people for economical and efficient operation of the courts. Districting remains one of the most controversial problems for the new courts. County boards of supervisors in drawing boundaries must balance the needs of operating efficiency, of accessibility and of the cities which have lost their own courts.

Jurisdiction of the inferior courts was, within certain constitutional limits, under legislative control. Class B justices' courts, those in townships under 30,000 population, had criminal jurisdiction over most misdemeanors and civil jurisdiction to a $300 limit. Class A courts had slightly more extensive criminal jurisdiction and a $1,000 civil limit. Justices of the peace were also judges of the small claims court. Territorially jurisdiction overlapped and conflicted with that of other inferior courts. In the new court system the justice courts have somewhat greater jurisdiction than the class B courts had. Most jurisdictional problems are solved by elimination of many courts and by clearer venue provisions.

Over four million original cases of all categories were filed in California's courts during the year, July 1, 1949 to June 30, 1950. A large proportion of these were filed in the justices' courts. While traffic cases were the most numerous kind handled by the J. P.'s, they were proportionally less important than in other inferior courts. Analysis of court business provides other information about the operation of the courts. Study of justices' court finances reveals, among other things, that they operated at a profit to the counties.

In addition to their main task of adjudicating cases, justices of the peace had additional powers and duties. Of these, responsibilities for handling money and for

record keeping were of most significance. Maintenance of court dockets was a special problem.

Most class B justices of the peace were laymen serving part-time. Class A justices were required to be attorneys. In spite of their lack of formal training most class B J. P.'s seemed reasonably competent to perform their functions. To assure a higher quality of judicial competence in the new courts, justice court judges must either be lawyers or else have passed a qualifying examination. Compensation of the justices of the peace was generally not adequate to attract the best qualified men. Since salaries remain under control of county supervisors, little improvement can be expected.

The movement to reform the inferior courts originated with the State Bar. The Commonwealth Club, the Justices' and Constables' Association and the Judicial Council also played leading parts in the movement. The reorganization plan drafted by the Judicial Council under a directive from the State Legislature clearly represented a compromise between the views of the Bar and the Justices' and Constables' Association. With no organized opposition, the new plan passed easily through the Legislature and was overwhelmingly approved by the voters.

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THE ROLE OF THE FEDERAL COUNCIL OF THE CHURCHES OF CHRIST IN AMERICA IN THE FORMATION OF AMERICAN NATIONAL POLICY

(Publication No. 5567)

Kenneth Nelson Vines, Ph.D.
University of Minnesota, 1953

The unusually large number of divisions into which the Protestant religion was split in the United States led historians to term the United States the "classic land of sects." Yet, in the latter part of the nineteenth century, an increasing number of Protestant churches began to organize or as they termed it, "to federate" for the accomplishment of purposes that could be better done in cooperation than in separation.

An examination of the records of these movements indicates that the Protestant churches were motivated toward federation by a feeling that the profound social and economic changes of the nineteenth century had produced a crisis in the Protestant church. In particular, the new immigrants coming mainly from Catholic countries, the working class, the city, the ideologies of socialism and secularism and the increasingly powerful Catholic church were regarded as constituent threats in this crisis. This feeling that the Protestant church should cooperate to meet these threats to the Protestant way of life led eventually through a series of preliminary federative organizations to the culminating organization of a federal council of churches in 1908. The Federal Council of Churches remained the organized representatives of Protestantism until 1950 when it, with other interdenominational Protestant organizations, was merged into the National Council of Churches.

Consisting of thirty-three organizations at the outset, the Council managed to retain its denominational membership with only occasional withdrawals by the denominations. The ability of a denomination to withdraw from the Council in addition to the fact that a denomination might except itself from actions and pronouncements by the Council, calls into question the genuine federative nature of the Council. Although the Council could not coerce individual members of the Council it was empowered to perform certain central tasks, the most important of which, for political analysis, was to increase the influx of the church in all matters affecting the moral and social welfare of the people. In both its organization and political processes the Council tended toward more centralized responsible control, with increasing emphasis on "officiality" and clear lines of responsibility. Power became concentrated in the Executive Committee of the Council as the activities of the administrative departments of the Council were restricted.

In its activities as a pressure group, the Council worked through the legislature, the President, the administrative agencies in Washington and eventually through the courts. Frequent appearances were made before Congressional committees, numerous letters written to Congressmen and personal contacts cultivated among the Congressmen. Officers of the Council had particularly close personal relationships with the President of the United States, and the record indicates the President was particularly responsive to the Council's pressure.

Activities designed to influence public opinion were among the more consistently important and numerous of the Council's activities. Publicity campaigns to secure the passage of prohibition laws and the abolition of the twelve hour day in the steel industry were examples of this activity. Less spectacular but perhaps of more enduring significance were the efforts of the Council to educate through research and education. Literally millions of pamphlets were published and distributed in pursuit of this aim.

In conclusion, it may be observed that the Council's activities and organizational tendencies revealed a transition from the sect-type religion of traditional Protestantism to the church-type as exemplified by Catholicism. The original objective of the Council, to win the city for Christ, was integrated with many more objectives and activities as the Council set out to "promote the law of Christ in every relation of life."

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PSYCHOLOGY: GENERAL

PERSONALITY ADJUSTMENT OF AGING WOMEN

(Publication No. 5914)

Alvis Wayman Caliman, Ph.D.
Michigan State College, 1952

The purpose of this investigation was to make a personality study of 45 Negro women between the ages of 50 and 83, residing in Lansing, Michigan. The sample had previously been used in a nutritional study reported by Dr. Margaret A. Ohlson, Head, Department of Foods and Nutrition, Michigan State College (5). It was hoped that the investigation would provide an answer to the following questions:

1. How do Rorschach findings for these women compare with findings reported for other samples of normal adults and aged persons (2, 4)?
2. Are there differences related to age in the personality structure of these women as indicated by the Rorschach test?
3. Is activity related to age differences, and to differences in level of emotional adjustment?
4. Is the health status of the sample related to age differences, and to level of emotional adjustment?
5. Is dietary status related to age differences, and to level of emotional adjustment?
6. Is there relationship between socio-economic factors and level of emotional adjustment?

The Rorschach test (1) and the Activity Inventory (3) were administered to each woman individually by the writer. Results of medical examinations, nutritional data, individual health ratings, and socio-economic data were made available by Dr. Ohlson.

To ascertain age differences, the sample was divided into two groups: Group I, 22 women 50 to 59 years of age; and Group II, 23 women 60 to 83 years of age. The Rorschach tests for each age group were rated individually by three judges in order to determine the best and poorest adjusted women.

The major findings were reported as follows:

1. The Rorschach findings indicated that the ability to perceive environmental situations adequately had not declined with age. The aged women were no more stereotyped in their thinking than other normal samples from different age groups. There had been no loss of emotional control for the sample as a whole. In respect to age differences, Group I gave significantly more Anatomy responses than Group II. This difference was interpreted as related to the menopause.
2. The Activity Inventory findings indicated that the women of Group I were more active than the women in Group II. In addition, women of both age groups rated as best adjusted, were more active than the women rated poorest in emotional adjustment.
3. Women judged as best adjusted were found to have a better health status than the poorest adjusted women.
4. On the whole the best adjusted women tended to have better dietary intake.
5. In the present sample there was no significant relationships between socio-economic factors and level of emotional adjustment.

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THE EFFECT OF MOVING AND NON-MOVING VISUAL STIMULI UPON HEAD TORSION

(Publication No. 5837)

Kenneth Ashton Chandler, Ph.D.
Clark University, 1953

The goal of this study was to extend our basic knowledge concerning the organism's mode of coping with environmental stimuli. An approach to this problem which has proved to be extremely fruitful has been that of the sensory-tonic field theory of perception. Working with perceptual situations it has been shown that perceptual activity is a function of particular "stimulus-object" – organismic relationships. Basic to such relationships is the sensory-tonic state of organism; by virtue of changes in the organismic state induced by stimulation, different perceptual effects have been noted.

Implicit within the sensory-tonic theory is the assumption that changes in the state of the organism may be expressed not only perceptually but also through actual body motion. A further assumption is that just as different perceptual effects occur for different stimuli (extraneous and object), so will differential

body reactivity occur for different stimuli. Here we are concerned with the question of body movement as an expression of organismic change induced by different types of visual stimulation. The purpose of this study was:

1. to develop an apparatus and experimental methodology by which organismic change expressed through body movement can be studied;

2. to test specific hypotheses, suggested by the sensory-tonic theory of perception at its present stage of development, concerned with body motion.

Accordingly, the effects of moving and non-moving visual stimuli upon head torsion (the index of body motion) were investigated with 72 adult Ss. The moving stimuli consisted of vertical luminescent stripes rotating around the S to the left or right at two speeds, 2 r.p.m. and 7 r.p.m. The non-moving visual stimuli consisted of (1) extraneous homogeneous uniocular light stimulation, (2) solidly illuminated triangles and squares placed asymmetrically to the left or right of the objective median plane. These solidly illuminated figures were of two types; those possessing only asymmetrical extent (squares) and those possessing in addition to extent, the quality of directional dynamics (left-pointing and right-pointing triangles). Measurement of head torsion was taken once per second for 60 seconds, thus providing a pattern of head movement in time. Such changes in head torsion were expressed in terms of the slope (rate in degrees per second) of the best fitting straight line fitted to the data for each individual for each trial.

In general it was found that statistically significant changes in head torsion occurred as a function of extraneous and object stimulation. Effects of this kind were obtained for extraneous visual stimulation (uniocular illumination), moving-object stimulation (rotating visual stripes) and stationary-object stimulation (asymmetrically placed figures and/or figures with directional dynamics). More specifically, uniocular homogeneous illumination induced head torsion away from the side of stimulation (e.g., left eye stimulation induced head torsion to the right). Moving object stimulation induced head torsion in a direction commensurate with the direction of object movement (e.g., stripes moving left induced left head torsion). Evidence is presented that suggests head turning toward figures not possessing directional dynamics (squares) and head turning in the direction of the configurational dynamic (e.g., left-pointing triangle induced left head torsion). However, because of the limited evidence concerning this particular problem further experimentation is required to confirm or disconfirm the hypothesis of differential head torsion for figures having the object qualities of asymmetrical placement compared with those having the qualities of directional dynamics.

In general, the experimental findings are interpreted in terms of a construct of sensory-tonic theory concerning the relation of stimulus and organism, viz., minimal disturbance (equilibration: symmetrization). Disturbing stimuli (stimuli which induce changes in the sensory-tonic state of the organism) may be handled effectively by the organism through counter-balancing (as was the case with the uniocular light stimulation) or following movements (as is suggested with both moving and non-moving object stimuli). Thus the establishment of harmonious relationships through head torsion provides further information relative to the broader psycho-biological question concerning how the organism copes with the environment. Further, the heuristic value of the sensory-tonic field theory of perception, proposed by Werner and Wapner, has been demonstrated.

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FACTORS RELATED TO SCORES ON THE F (PREDISPOSITION TO FACISM) SCALE

(Publication No. 5655)

Thomas Simon Cohn, Ph.D.
University of Michigan, 1953

Studies of the validity of the F scale, an indirect measure of anti-democratic tendencies at the personality level, have been inconclusive. A review of the literature reveals a consistent relationship between the F scale and various indices of an intellectual factor. In this thesis this relationship is interpreted in terms of reference group theory. It is hypothesized that the more intelligent and scholarly students are more adept at discerning the responses desired by the reference group (the teacher). Several studies were conducted to demonstrate this. In one group, a significantly larger number of the more intelligent, scholarly subjects shifted their responses from their original F scores toward the teacher's F score when asked to predict how the teacher would respond to the F scale. In another group, the more intelligent subjects were more adept at predicting F scores at extreme reference groups. A third study was carried out without any set specified but two students administered the F scale the first time, the teacher the second time. The low F scores shifted toward the teacher's F score.

A second variable, termed a response set to answer positively was identified and found related to F scale scores. The quantification of this variable was achieved by using the total number of true responses on the Minnesota Multiphasic Inventory. This measure, along with a similar measure of response set to answer positively, a measure of intelligence, a measure of grade-getting, the F scale administered with a set to answer as the teacher, and the F scale, were factor-analyzed. Two factors, one apparently intellective, the other the response set, contributed heavily to the variance of the F scale.

In order to develop a shorter measure of the response set, the MMPI was item analyzed in terms of an extreme group answering the most "trues" versus an extreme group answering the least "trues." Of the ninety items significantly differentiating, thirty-three were selected (Plus scale) and administered to a new group, along with the F scale and a measure of

intelligence. The F scale was significantly correlated with the Plus scale and intelligence measures, whereas the Plus scale and intelligence measure were uncorrelated. The Plus scale was then analyzed empirically and found to be a group of unstructured items that were as likely to be answered true as false.

To experimentally test the response set variable, the F scale was reversed and the reversed form administered along with the original form to a new group. Results indicated that a response set to answer positively is partially responsible for F scale scores.

In conclusion, two factors involved in F scale responses are identified. Implications of this finding are discussed.

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RATE OF RECONDITIONING AS A FUNCTION OF AMOUNT OF EXTINCTION

(Publication No. 5864)

Angela Snell Homme, Ph.D.
Indiana University, 1953

This study was an investigation of rate of reconditioning as a function of amount of extinction.

Four experimental groups, each composed of 16 female white rats, reacquired the bar pressing response in the Skinner box following 0, 1, 5, or 12 daily one hour extinction periods. Two groups of animals were included to serve as controls for the 12 day extinction group: one to obtain an estimate of response strength change from conditioning to reconditioning, and another to determine the effect of extinction to all stimuli except stimulation provided by the bar press in 12 daily one hour periods between conditioning and reconditioning. Operant levels with and without prior magazine training were also obtained.

The results indicated:

1. The more extensive the extinction preceding reconditioning the slower the reacquisition of the bar pressing response; the relationship appears to be a negatively accelerated, monotonic decay function. Reduction in response strength from conditioning to reconditioning is related to extinction of the bar pressing response itself rather than to the time lapse or non-reinforcement in the presence of stimuli associated with placement in the box and all other stimuli except those arising from bar pressing.

2. Rate of reconditioning, as measured by total number of responses during the six minutes following the first bar pressing response, was significantly faster than rate of conditioning for all values of the extinction variable except the 12 day value.

Cumulative conditioning and reconditioning curves for the four experimental and two control groups and cumulative conditioning curves for the operant-magazine group were fit by approximation with the equation derived by Estes. It was found that this equation generates curves which fit the data very closely.

$$R = wt - w/B \log \frac{r_o/w - w - r_o/w}{} e^{-Bt}$$

An attempt was made for each group to hold w and B constant from conditioning to reconditioning with variations occurring only in r_o. It was necessary, however, to increase all parametric values from conditioning to reconditioning with the exception of r_o for the 5 day extinction group and the 12 day extinction group.

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THE RELATIONSHIP OF ACADEMIC ADVISEMENT TO THE SCHOLASTIC PERFORMANCE OF COLLEGE PROBATIONARY STUDENTS

(Publication No. 5480)

Edwin Lewis Klingelhofer, Ph.D.
State University of Iowa, 1953

The purpose of this investigation was to study, under careful initial control of predetermined biasing factors, the relationship of academic advisement to the scholastic performance of college probationary students.

A group of sixty-nine male and female scholastic probationers who had enrolled on or after September, 1950, and had been placed on scholastic probation for the first time in June, 1952 in the College of Liberal Arts of the State University of Iowa constituted the experimental subjects. They were randomly assigned to a "more" or "less" intensively counseled subgroup the compositions of which had been controlled for sex, fraternity or sority membership and total hours of college work completed, the control variables being applied following the results of two preliminary studies.

The individuals in the "less" intensively counseled sub-group received one hour of intensive, directive advisement early in the first semester of the 1952-1953 academic year; the individuals in the "more" intensively counseled sub-group were given the first interview plus three additional ones spaced during the first semester of the 1952-1953 academic year. All counseling was carried on by the author in the Liberal Arts Advisory Office, the agency which enforces scholastic standards in the College of Liberal Arts of the State University of Iowa. No interviews were missed with any subjects.

Two sets of comparisons were made, one being the comparison of the "less" and "more" intensively counseled groups of the Experimental Study, and the other being a comparison of the subjects in the Experimental Study with a highly similar group of probationers from the preceding year. These comparisons were effected after it had been ascertained that the "more" and "less" intensively counseled groups of the Experimental Study and the Experimental group and the Control group from the year preceding were equivalent on a large number of variables selected out for analysis.

The comparisons of the sub-groups of the Experimental Study and the Experimental Study versus the preceding year's control group on the criterion measure (grade point average for the semester after being placed on probation) revealed:

1. Four hours seem to be more effective than one hour of organized academic advisement in producing improvements in the grade point averages of selected failing students in the College of Liberal Arts of the State University of Iowa.

2. An organized counseling program featuring at least one hour of academic advisement seems to be associated with levels of scholarship for selected failing students in the College of Liberal Arts of the State University of Iowa which are reliably higher than those for comparable uncounseled students.

A discussion of these results outlined some of the possible reasons for their appearance, and concluded by suggesting the desirability of a formal guidance program for probationers which features one relatively short, highly structured directive interview with a counselor identified with the office administering probationary procedures. Presumably such a program would be effective for individuals selected similarly to the subjects in the experiment and the two preliminary studies, and who were in residence at institutions employing admissions procedures and probation routines like those in force at the present institution.

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THE PERFORMANCE OF ADULTS UNDER DISTRACTION STRESS: A DEVELOPMENTAL APPROACH

(Publication No. 5845)

Stanley H. Lofchie, Ph.D.
Clark University, 1953

A review of the literature on stress experimentation suggested that distraction is a factor in many if not all stress techniques – and that of the stress techniques applied heretofore, distraction itself represented the least ambiguous case. For these reasons it was felt that an investigation of individual differences in reaction to distraction might prove fruitful in contributing to an understanding of functioning under stress.

The present study was undertaken within the framework of genetic theory as evolved by Werner. With reference to performance under distraction, the following proposition was advanced: Those individuals with a higher capacity to organize the behavioral field should tend to respond selectively to that which is relevant. That is, such individuals are capable of distinguishing the essential from the non-essential and of organizing their behavior in such a fashion that the non-essential does not impair their reaction to the essential. This proposition led to the specific hypothesis that the present experiment tested: those individuals whose functioning is characterized by developmental maturity (as measured by Rorschach developmental scores) would demonstrate more adequate performance under distraction stress than those individuals for whom this characterization was less applicable.

This hypothesis was tested on a group of thirty-five normal, white, American-born male adults between the ages of thirty-four and forty-five. The methodology consisted of comparing the effect of distraction on performance by these subjects with their Rorschach protocols. The performance task utilized was a variation of the Dunlap Steadiness Test. The evaluation of the effect of distraction was made with allowance for the subject's abilities at the task as measured by his performance in a pre-test under standard conditions. Developmental maturity was evaluated by an analysis of the Rorschach protocols in terms of Friedman's Genetic Structural Scoring System.

The data obtained demonstrated a significant relationship between developmental maturity and adequacy of performance under distraction. This relationship was observed to be independent of the influence of intelligence, education, occupation, production of Rorschach responses and varying emphases in Rorschach location choice. It was concluded, therefore, that the experimental hypothesis was confirmed.

In a discussion of the implications of these findings for stress experimentation, genetic theory and clinical psychology, it was noted that the kind of methodology involved in the present experiment represents a new pattern for experimentation within the genetic framework and holds forth especially the possibility for investigation of individual differences within diagnostic classifications.

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THE DIMENSIONALITY OF RESPONSE PATTERNS FOR THE METHOD OF SINGLE STIMULI

(Publication No. 5704)

John Edgar Milholland, Ph.D.
University of Michigan, 1953

This study develops and illustrates a method for analyzing into components a complex trait or ability which generates the response patterns occurring when sets of test items are presented to subjects by the Method of Single Stimuli. Three kinds of models are recognized: the compensatory, in which a deficiency in one component may be compensated for by an excess in another; the conjunctive, in which minimal status in all components is required for a positive response to an item; and the disjunctive, in which minimal status in any one component results in a positive response. The study deals with the conjunctive and disjunctive models, which are isomorphic in formal structure, and with stimuli for which there are just two response categories.

Test items and individuals are regarded as existing in a multidimensional space, and the general problem of the study is the description of this space by means of unidimensional ordinal scales as axes. The concern is with the placement of items, rather than individuals, but analogous techniques are possible for locating individuals. Four aspects of the problem are considered: the number of dimensions required; the ordering of items on dimensions; the meaning of the dimensions; and the evaluation of the adequacy of a solution. The attack upon these subproblems is made through the development of an abstract model, and the model is then tested against four groups of data.

In the abstract model, the relation between a configuration of items and individuals in the space and the response patterns generated is investigated. The general problem is not solved, but two formulas are obtained; one for an upper bound to the number of possible ways of obtaining a given score from a configuration of n items in d dimensions; the other, for the special case of two dimensions, expresses the total number of possible patterns as a function of the number of items and the number of inversions of item orders between dimensions.

A technique is derived for reasoning back from a set of response patterns to configurations which could generate the set. In general, solutions are not unique.

The method of assigning meaning to the dimensions is to examine the items appearing on a dimension for common content.

To evaluate a solution, an extension of Guttman's concept of reproducibility (i.e., the extent to which a proposed solution could reproduce the response patterns) is used. Four different kinds of reproducibility are suggested: the proportion of individuals whose response patterns are reproducible; the proportion of different response patterns reproducible; the proportion of individual item responses reproducible (This is Guttman's reproducibility coefficient.); and the proportion of reproducible item responses in the different patterns.

Applications of the method are made to four sets of data, including ability items, personality inventory items, and occupational interest items. In one case a solution was not obtained, but in the other three it was possible to obtain and tentatively interpret configurations.

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PERSONALITY PATTERNS OF SOCIALLY SELECTED AND SOCIALLY REJECTED MALE COLLEGE STUDENTS

(Publication No. 5928)

Cyril Ralph Mill, Ph.D.
Michigan State College, 1953

The Problem

This study was designed to permit a comparison of the personality patterns of socially accepted and socially rejected individuals. The hypotheses to be tested were: (1) that social rejects would be more poorly adjusted; (2) that more seriously neurotic or psychotic manifestations would appear more frequently in the reject group; (3) that rejects would exhibit more anxiety and their mechanisms of defense would be less socially acceptable; (4) that the rejects would be less able to establish favorable interpersonal relationships and would exhibit greater hostility toward their environment; (5) that the rejects would be more inconsistent in their concept of self; (6) that the rejects would display more rigidity and concreteness of thinking.

Methodology

The population was drawn from the residents of a college men's dormitory and consisted of the 21 men shown by a sociometric study to be the most unpopular in the group. They were compared with the 21 men who were found to be the most popular. The groups did not differ in academic potentiality as determined by the ACE test, but the rejects were making lower grades, were younger, and less advanced in school.

The techniques used in the investigation consisted of the Minnesota Multiphasic Personality Inventory, the Rorschach, the Thematic Apperception Test, a Self Rating Scale to determine consistency in the self concept, and the Rokeach Map Technique to measure rigidity and concreteness of thinking.

Results

Both groups were found to contain members showing signs of maladjustment, but the rejects as a group were more disturbed. The rejects tended toward distorted interpretations of their environment and exhibited a test pattern similar to psychopathic deviation. Anxiety was greater among the rejects, and their mechanisms of defense tended to be offensive in the eyes of their peers. They tended toward feelings of inferiority and inadequacy, dissatisfaction with their present situation, and generalized hostility toward their environment. Aggression in the rejects tended frequently to be displaced from the actual source of their frustrations.

The selects tended to be more guarded and evasive in their test responses. They indicated that they could assume greater responsibility and take the ascendent role in face-to-face situations. They showed an ability to "sublimate" their sexual needs and interests. Their methods of handling their anxiety either did not interfere with their inter-personal relationships, or were actually conducive to improving their relations with others. They were more direct in the expression

of their aggression, and their behavior was more predictable to others with the result that they tended to make others feel more secure in their presence.

The rejects tended to be more inconsistent in their self concept, but there was no difference between groups in rigidity or concreteness of thinking as measured by the map technique.

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THE INFLUENCE OF ALTERATION OF STIMULUS CONTEXT ON GENERALIZATION IN VERBAL LEARNING

(Publication No. 5514)

Norman M. Paris, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor L. E Thune

This study investigated the amount of negative transfer obtained when two successive tasks were learned under conditions which permitted measurable and systematic variation of a small portion of the stimulus context, within which each of the tasks were learned. The negative transfer effect was produced by having subjects learn two paired associate lists of the A-B, A-K type.

It was hypothesized, first, that learning would take longer as a function of increased generalization, which in turn, is an inverse function of the degree of contextual similarity. Thus, generalization would be at a minimum (and rate of learning at a maximum) when contextual alteration is at a maximum. Secondly, it was predicted that alteration of the contextual stimuli would facilitate the learning of new responses to old stimuli.

The 120 subjects used were divided into five groups of twenty-four each and assigned to one of the four experimental and one control conditions in the order in which they presented themselves for the experimental sessions. After receiving five trials on a Practice List of paired nouns, subjects learned (by the anticipation method) two lists (List A and List B) of paired associate adjectives.

The independent variable was changes in the frequency of a tone accompanying the presentation of the stimulus items of the lists. All subjects first learned List A to the criterion of eight out of ten correct anticipations. Wearing earphones, subjects heard a tone accompanying the presentation of the stimulus member of each pair. They were then asked to learn List B (same stimulus items, as in List A, paired with new response adjectives). The criterion for List B was two successive errorless trials (with a minimum of ten trials). For half of the stimulus terms of List B under the experimental conditions, there were alterations in the frequency of the accompanying tones.

Under condition E-1, the change was 25 jnd's; under E-2 it was 50 jnd's; and there was a 75 jnd change under condition E-3. Under these three conditions, the remaining stimulus items were accompanied by the same tones as used with List A stimulus items. For the control condition the same tone was used for all of List A and List B stimulus items.

A test for transposition was included as condition E-4. For subjects assigned to this condition, half of the List B stimulus terms were accompanied by tones differing by 25 jnd's from List A tones; half were accompanied by tones differing by 75 jnd's from List A tones. Thus, the difference between the two tones employed in List B was actually 50 jnd's – the same as condition E-2. It was hypothesized that there would be no differences in the results between these two conditions.

The analysis of variance of three performance measures, all utilizing difference scores, by covariance adjustments for the performance on the five practice trials yielded F values that were significant at the one per cent level for 4 and 100 d. f. However, it was concluded that the 25 jnd change was not effective in reducing the negative transfer effect. It was suggested that this failure might be due to the operation of some unknown inhibiting or masking factor or factors.

The significance of the differences between results obtained under condition E-2 and E-4 were also tested by covariance methods. While the mean differences were not significant for two of the performance measures, the F value for what was considered to be the most stable performance measure was significant at the five per cent level for 1 and 45 d. f. It was concluded that, although the results were not clear cut, there was some indication that transposition, in general, failed to occur.

The general hypotheses were only partially confirmed. The 25 jnd change was not effective in reducing the negative transfer influence. However, under conditions E-2 and E-3, the amount of generalization was found to be inversely related, according to a negatively accelerated function, to the differences between the stimuli.

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A GENETIC STUDY OF INTUITIVE WORD MEANINGS

(Publication No. 5848)

Robert Harvey Pollack, Ph.D.
Clark University, 1953

The present study is concerned with the investigation of the intuitive or "physiognomic" aspects of word meanings. Specifically, this study deals with the development of intuitive word meanings as expressed through non-linguistic media, viz., colors and expressive lines.

Intuitive meaning, i.e., the extralogical, expressive

features of word meaning – has been discussed from a philosophical standpoint by W. Urban, in his book, Language and Reality. Urban in contradistinction to many philosophers of language who have argued for a dichotomy between cognitive and emotive meaning, urges that all language is essentially cognitive; from this it would follow that intuitive language must likewise have cognitive aspects. Werner, in his book, Comparative Psychology of Mental Development, discusses the problem of intuitive language within the general framework of "physiognomic experience" and has suggested that physiognomic word meaning may be considered in terms of developmental theory.

The present study is derived chiefly from the viewpoints of Urban and Werner. In terms of these viewpoints, four hypotheses concerning the development of intuitive meaning were formulated. It was held that there would be:

1. a development toward conventionalization of intuitive meaning;

2. an increase, differentiation, and precision of the formal elements of sign vehicles with age;

3. a development toward generalization of intuitive meanings;

4. a development toward differentiation (polarization of intuitive meanings.

In order to investigate these hypotheses, the following experiments were carried out:

Children of various ages as well as adults were presented with words of emotive connotation which they were to identify, (a) with colors (Experiment A), and (b) with their own line productions (Experiment B). Each of the words selected were members of one of two opposite meaning spheres, viz., of positive emotive valence and the other of negative emotive valence, (e.g., rich – poor). In each of the two experiments, the words were presented singly (Sub-Experiments A1, B1), and also in contrasting pairs (Sub-Experiment A2, B2). The design thus offered an opportunity to study the effect of a relational context intuitive meaning.

The hypotheses, in general, were confirmed.

From the statistical analysis, the following results were derived:

1. There is evidence that positive and negative valences are related to definite expressive characteristics of colors and lines. For the line experiment, there is an increase with age in the number and the differentiation of formal elements expressing word meaning.

2. There is an increase with age in the systematic relation of positive and negative valence on the one hand, and the respective expressive characteristics conveyed by colors and lines on the other hand.

3. There is a genetic increase in the effect which the introduction of the context of opposition has upon intuitive word meanings. That is, compared with presentation of single words, the introduction of words as opposite pairs makes more definitive the systematic relationship between emotive valence and the expressive characteristics of the media employed; this effect is not significant at the youngest age level but is significant with older children and adults.

4. A final analysis was carried out utilizing verbal statements made by the subjects concerning relationships between meaning and expressive characteristics of lines. The results of this analysis, concomitant with the results concerning the formal characteristics of the produced lines led to the following conclusions:

a. There appears to be a development in terms of an increase in the universality of graphic signs expressive of certain meanings.

b. Reflected in the verbalization, there also appears a corresponding trend toward objective expression of "intuitive" meanings of words.

The results of the two experiments were finally discussed within the framework of Werner's developmental theory of cognition.

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A STUDY OF RELATIONSHIPS BETWEEN CERTAIN SOCIO-ECONOMIC FACTORS AND THE STRONG VOCATIONAL INTEREST BLANK FOR WOMEN

(Publication No. 5556)

Dorothy Frances Snyder, Ph.D.
University of Minnesota, 1953

The purpose of the study was to investigate factors which might be related to the measured interests of high school girls. The sample consisted of 3044 high school seniors who took the Strong Vocational Interest Blank for Women and completed an "After High School, What?" questionnaire in the Spring of 1950 as part of the Minnesota state high school testing program. The sample was divided into three residential categories: metropolitan, rural non-farm, and farm.

The first comparisons were those in which differences among these three residence groups were studied. The students included in the metropolitan sample tended to be younger, to have parents with a greater amount of formal education, and to be more likely to have fathers in professional or business occupations than were the students in the non-metropolitan samples. The girls in the metropolitan sample also were more likely to be planning to attend college than the others. The scores on the Strong Vocational Interest blank for all three residence groups showed a preponderence of "C" ratings, with "A" and "B+" scores in the majority only on the office worker, stenographer, and housewife scales. Students in metropolitan high schools were found to have fewer primary patterns (A or B+ scores on half or more of the keys in a family) than those in the other two residence groups. Within each residence group the results of various comparisons between total number of primary patterns and other social-economic variables did not point to any clear trend.

When the existence of primary patterns on the Group VIII family (housewife and elementary teacher) was studied, it was found that the farm groups had the largest proportion of primary patterns in this family

and the metropolitan group the fewest. The metropolitan group was, therefore, shown to have both fewer primary patterns and fewer Group VIII primaries. Within each of the residence groups there was a tendency for a primary pattern on the housewife's scale to be associated with a greater number of other primary patterns.

Primary patterns on the Group VIII keys tended to be positively related to several of the questionnaire variables studied. If we assume that there is a "housewife" type of girl with a primary pattern group in Group VIII, these results indicated that her father would not be in a professional occupation; her mother, if she worked before her marriage, was not in a professional field; both parents had less formal education than those of other girls; the girl herself did not expect to attend college; and she had a lower ACE score. While the results were not uniformly consistent through the three residence groups, the presence of primary patterns on the Group VIII scale appeared to be associated with lower levels of what might be considered family status. From the results of this study it appeared that there was no well defined pattern of variables which were associated with "career" interests, but there were socio-economic factors related to "housewife" interests.

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THE QUANTIFICATION OF PERSONAL DATA FOR USE IN A MULTIVARIATE STATISTICAL ANALYSIS OF DIFFERENCES BETWEEN SELECTED GROUPS OF COLLEGE STUDENTS

(Publication No. 5559)

William Charles Stevens, Ph.D.
University of Minnesota, 1953

Most of the numerous studies on prediction of academic achievement have used correlational analysis. Relatively few investigations have used several variables and several groups on which predictions were to be made. Usually, when several variables and several groups were considered, investigators have used either one group and several variables, or one variable and several groups.

The type of analysis used in this investigation makes it possible to study, at one time, several groups and several variables. The technique is appropriate to many problems in psychology and education, and may yield more information than statistical techniques which are limited to one group and one variable at a time.

This investigation dealt with the differences, with respect to six variables, between five groups of college freshmen following different pre-professional curricula. The six variables, items from a personal inventory, were as follows: number of high school subjects liked, number of high school subjects disliked, number of jobs, number of activities, number of offices and number of hobbies. Five preprofessional groups were in the experimental sample of two hundred and ninety-nine students: prelaw students, prebusiness students, premedical students, a group training for other medical specialties, and an unsuccessful group, composed of students who attempted one of the above curricula, but failed to maintain an adequate scholastic average. A cross-validation study was carried out, using a new sample of one hundred and eighty-eight students.

Discriminatory analysis was used to assign weights to the responses on the personal inventory. The technique utilizes the principle of determining the weighting of the data directly from information provided by the data themselves, rather than on an a priori or arbitrary basis.

The assumptions of homogeneity of variance and homogeneity of covariance were tested. Because of limitations imposed by the weighting technique, the assumptions of normality of distribution and linearity of regression were not tested. Scatter diagrams and normal probability graphs were presented. Not all the assumptions were met.

Overall differences between the groups were tested and found to be significant at the .01 level.

D^2 values were computed between all pairs of groups. Three were significant at the .01 level, two at the .05 level, and one at the .10 level. Comparisons of relative distances between groups could be made from these D^2 values.

The dimensions of variation were investigated. One dimension was significant at the .01 level, and one at the .05 level. It was difficult to name these dimensions, because each one was a compound of all six variables, but the main components were, for the first dimension, the number of high school subjects disliked and the number of hobbies, and for the second dimension, the number of high school subjects liked and the number of offices held.

Canonical variates were obtained, and the data were presented graphically.

A linear discriminant function was obtained for each group. Five linear discriminant scores were computed, and an individual in the cross-validation sample was assigned to the group for which his score was highest.

The number of correct classifications in the cross-validation sample was significantly better than chance.

Multivariate analysis of the type employed here is efficient because it utilizes all of the information provided by the data in a single analysis, compared with the usual type of correlational analysis applied to single groups, or to multiple groups, one at a time,

The thesis is presented in such a way that it can be used as a guide in the application of these techniques to other problems in psychology.

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PSYCHOLOGY: CLINICAL

THE ACQUISITION OF VERBAL CONCEPTS IN SCHIZOPHRENIA: A DEVELOPMENTAL APPROACH TO THE STUDY OF DISTURBED LANGUAGE BEHAVIOR

(Publication No. 5835)

Robert William Baker, Ph.D.
Clark University, 1953

This research attempted to investigate structural characteristics of schizophrenic language behavior. It was hypothesized that schizophrenics would function at a genetically earlier level of language organization than would adult normal individuals.

The technique employed was a test made up of six series of six sentences, an artificial word appearing in each sentence. Six artificial words were used, a different one for each series. With the sentences presented one by one, the subject's task was to determine the meanings of the unfamiliar words. The experimenter asked how proferred solutions fit contexts, thus ascertaining "process" underlying "achievement." This test was a modification of the Word-Context Test, used previously by Werner and Kaplan in a study of language behavior in children (40).

There were two groups of subjects, 15 adult males in each, matched for age, intelligence, and education; one consisted of schizophrenics, the other of normal controls.

Three aspects of language behavior were analyzed: (a) accuracy of solutions; (b) processes by which artificial words are signified; and (c) concreteness of language attitude. The scoring was done by three judges.

The results were as follows:

(a) Accuracy. Schizophrenics developed significantly fewer correct solutions.

(b) Signification processes. These processes are arranged in a genetic hierarchy from lesser to greater maturity. This hierarchy, predicted by Werner and Kaplan from their theoretical formulations, was verified by the results of their study.

The most primitive processes, sentence-core concepts and the holophrastic gradient – reflecting word-sentence undifferentiatedness, semantic instability, and holophrastic conceptualization – occurred significantly more frequently among schizophrenics.

Three processes involving a lesser degree of word-sentence undifferentiatedness, but where solutions are embedded in their contexts – aggregation, pluralization and transposition – did not distinguish the groups. A statistical trend occurred, however, in aggregation, the most primitive of the three categories. The failure of pluralization and transposition to differentiate the groups may result from the patients' inability to recognize as consistently as the normals the need to integrate two or more sentences by one solution, a condition necessary for the occurrence of either process.

Nonsentential holophrases – characterized by relatively distinct separation of word and sentence, but where solutions are holophrastically extensive and semantically unstable – narrowly missed statistical differentiation of the groups.

In the most mature processes, syncretic and fluidic conceptualization – where solutions are neither contaminated by sentence elements nor holophrastically conceived, but involve some degree of semantic instability – no statistical trends were manifest.

(c) Concreteness of Language Attitude. Concreteness in language attitude took two forms: word and sentence realism.

Three types of word realism – homophonic symbolism, neologic symbolism and a-referential usage – reflect undifferentiatedness of sound pattern and meaning. Subjects look for meanings in the phonic characteristics of the artificial words. The groups were distinguished significantly both by the incidence of composition of these forms and proportion of members manifesting these processes, the only case in which the latter type of analysis accomplished a significant separation of the groups.

Sentence realism, involving concrete apprehension of the test sentences as statements of information concerning real events, had significantly higher incidence among schizophrenics.

Those processes, then, which Werner and Kaplan found to be most characteristic of the youngest age groups of children, were the same ones which most clearly differentiated the schizophrenic from the normal subjects. The more the various processes tended to persist with the older children, the less clearly they distinguished between the two adult groups. It was inferred, consequently, that the level of language function in the schizophrenic is more similar to that of the young child than it is to that of the normal adult. Schizophrenics, like young children, manifest a lower degree of differentiation between sound pattern and meaning and between word and sentence, a greater degree of concreteness in language attitude, and a more pronounced tendency to holophrastic conceptualization and semantic instability. The study's hypothesis, therefore, appears to have been supported.

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THE INTERPRETATION OF MMPI PROFILES OF COLLEGE WOMEN

(Publication No. 5520)

John Davies Black, Ph.D.
University of Minnesota, 1953

A representative sample (N = 206) of undergraduate women at Stanford University was administered the Minnesota Multiphasic Personality Inventory, and the test results are studied in relation to a list of 140 adjectives, checked by the subjects to describe themselves and one another; sociometric ratings; and data from university personnel records, including scholastic aptitude scores, grade point averages, ratings of

social adjustment, etc. The purpose of the study is to investigate the validity of the MMPI with a "normal" college population and, if possible, to provide data which might be useful to counselors and psychologists employing the test in colleges.

Mean profiles from 15 studies totalling 5014 college women are compared and produce a characteristic profile with Hs, D, and Mf at or slightly below T = 55, with Ma ordinarily the peak. Profiles were also coded and the incidence of various profile shapes is found to be very similar in large samples of college women from three universities. It is concluded that MMPI performances are not significantly distorted by local cultural differences and that local norms are unnecessary and undesirable. The changing incidence of the various MMPI profile codes with age is shown to have implications for personality theory.

On the basis of peer nominations, 15 criterion groups, each containing from 12 to 25 Stanford girls, were chosen and are shown to be significantly differentiated from the total group by mean MMPI scores in 26 cases and by incidence of certain codes in nine cases. The 15 categories include girls chosen as "Most Likeable," "Most Athletic," "Best Leaders," "Least Mature," etc. It is concluded that, although based on Kraepelinian diagnostic categories, the MMPI scales have meaning within the normal range and that the test is at least as useful in selecting girls having superior adjustment and effectiveness as in predicting maladjustive tendencies.

The 206 subjects were grouped according to the one or two highest points on their MMPI profiles (and, in three cases, by the lowest point) and the self and peer adjective check lists were analyzed for each group. This results in lists of adjectives which are associated with 15 different profile codes in a population of college women. In addition, the interaction of certain scales (e.g., Sc and Ma, Hy and Hs) is clarified and the meaning of low scores on Mf, Pa, and Ma is investigated. It is concluded that in most cases profile peaks have significant meanings, even though the absolute scale elevations are small, and that the method of classifying persons according to their test performances and then studying their behavior is fruitful and logically sound.

The effectiveness of the MMPI as a screening instrument among college women is investigated by comparing the 25 girls with the most deviant MMPI's with a group of non-deviants and, in some cases, with the entire enrollment of women. The MMPI-deviant group has significantly poorer ratings on mental stability and participation in student affairs, significantly more violations of social regulations, and evoked many more unfavorable comments from the dean of women. The deviant groups also tend to earn lower grade point averages, to be underachievers, to drop out of college more frequently. The results are considered sufficiently promising to encourage further research and to recommend the MMPI for locating girls who may have difficulty in adjusting to college life.

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AN EXPERIMENTAL APPROACH TO THE MEASUREMENT OF SELF EVALUATION AMONG ADOLESCENT GIRLS

(Publication No. 5521)

Harriet Eleanor Blodgett, Ph.D.
University of Minnesota, 1953

Problem

To study the measurement of self evaluation by means of original paper and pencil techniques, and by a puzzle-frustration situation individually administered to a sub-sample.

Sample

Entire female population of a public junior high school (7th, 8th, and 9th grades) in a town of 25,000 population. 164 girls in main experimental group, CA 11 to 16, IQ borderline to very superior. 60 girls in cross-validation sample, similar to main experimental group except for exclusion of IQs below 90.

Measures

6 paper and pencil measures at 4 levels of directness of approach:

I. Most direct: adjective checklist with positive and negative choices for security, affection, recognition, and adventure.

II. Semi-direct:

1. Sentence completion test.
2. Multiple choice test with behavior and attitude choices.
3. Two-self descriptive compositions: first, to identify subject if lost in city of blind people; second, to identify subject if lost in city of seeing people.

III. Indirect: subject to indicate on rating scale position of person next above and of person next below self, for variety of activities; midpoint of two ratings taken as self rating.

IV. Concealed: paragraphs written incorporating three introductory words and selecting one word from each of seven pairs which include a positive and a negative word.

Three types of informational blanks completed:

1. Guess Who test, with eight personality descriptions.
2. One Day's History blank, listing activities for one school day and one Saturday.
3. What Do You Do? blank, including family information, activities, and responsibility questionnaire.

Data available from school records included. IQ scores, parent occupation, achievement test scores, and teachers' ratings.

Procedure

1. Highest and lowest 25% of adjective scores compared with objective data.
2. Exploratory comparisons made between subgroups selected by varying criteria.
3. High and low criterion groups based on achievement and social acceptance selected from large experimental sample and compared on self measures.

4. High and low criterion groups based on achievement, IQ, Guess Who votes, and teachers' ratings selected from cross-validation group, and compared on self measures.

5. Further consideration of theory of self led to classification on clinical judgment basis of puzzle-frustration subjects into four groups of quality of ego strength: healthy, defeated, discouraged, compensatory.

6. Comparisons made by critical ratio technique and significance of differences between percentages.

Results

1. High criterion group from large sample has higher scores on two most indirect measures; low criterion group has higher inferiority scores.

2. High criterion group from cross-validation sample also excels on indirect measure scores.

3. Of clinically selected groups, healthy group shows more social and group interests, higher scores on most of the positively-oriented measures, and better group acceptance; compensatory group shows fewer, and defeated group more inferiority feelings.

4. Range of scores for clinically selected groups consistent for some measures with theory that average scores of compensatory will be highest, healthy next highest, and defeated lowest, with discouraged group showing most variability.

5. Indirect approaches seem most consistent in revealing differences between groups.

6. Interpretation and application of categories of ego strength considered in relation to areas of adjustment, personality development, and therapy.

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READING RETARDATION AS RELATED TO PERSONALITY FACTORS OF CHILDREN AND THEIR PARENTS

(Publication No. 5641)

Robert Dean Boyd, Ph.D.
University of Michigan, 1953

Many writers have discussed the involvement of personality in reading retardation, but few have attempted research with emphasis on personality factors of children and their parents as related to reading. Psychoanalytic theorists, attempting to relate personality development to failure to learn to read adequately, stress the importance of sublimation breakdown as related to the oral stage of psychosexual growth and weakness in the identification process. This study attempts to evaluate the impact of personality factors of poor readers and their parents within this framework of psychoanalytic theory.

Matched on a number of criteria thought to be related to reading, twenty-three fourth and fifth grade boys retarded in reading were compared with a like number not retarded. Measuring devices for the children included the Blacky technique, the Vineland Social Maturity Scale, and the Wechsler Intelligence Scale for Children. Parents of the good and poor readers completed the Guilford-Zimmerman Temperament Survey and were interviewed.

In line with psychoanalytic theory, predictions were made that: (1) poor readers would be judged disturbed on a greater number of Blacky dimensions; (2) poor readers would more frequently be judged disturbed on those Blacky dimensions pertaining to the oral period and the identification process; (3) poor readers would show lower social maturity; and (4) mothers of poor readers would show relative masculinity while fathers of poor readers would show relative femininity.

The more salient findings follow: (1) poor readers were not judged disturbed on a significantly larger number of Blacky dimensions; (2) good readers were judged disturbed more often on Oral Eroticism but less (not significant) often on Oral Sadism; (3) poor readers were judged disturbed more often on Identification Process; (4) poor readers did not show significantly lower social maturity; (5) mothers of poor readers were more frequently relatively masculine while their husbands were relatively feminine.

Additional findings follow: (1) mothers and fathers of poor readers differed from mothers and fathers of good readers on certain personality variables, with parents of good readers showing better adjustment patterns; (2) mothers and fathers of good and poor readers could be "clustered" into subgroups with different strengths and weaknesses on the Guilford-Zimmerman profiles, and on comparison of these clusters, parents of poor readers showed poorer personality adjustment patterns; (3) the only unique husband-wife personality variable interaction pattern was in masculinity; (4) failure to express emotions appeared as the principal "masculine" characteristic of mothers of poor readers and expression of emotions the principal "feminine" characteristic of fathers of poor readers; (5) conditions other than parental personalities may be involved in the identification process; (6) parents of poor readers admitted greater emphasis on early toilet training and more disagreement regarding child discipline; (7) poor readers scored lower on arithmetic and verbal functioning on the Wechsler.

Conclusions from these findings would suggest: (1) the need to revise the theoretical assumption that early oral deprivation is related to reading retardation; (2) confirmation of the theoretical assumption that disturbance in the identification process is related to reading retardation; (3) that parental personality variables are related to reading retardation.

Limitations of the study were discussed and suggestions were made for further research.

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AN INQUIRY INTO THE PSYCHOLOGICAL EFFECTS OF ADRENOCORTICOTROPHIC HORMONE ADMINISTRATION

(Publication No. 5787)

Alan DeWitt Button, Ph.D.
Stanford University, 1953

Stimulated by many reports in the medical and psychiatric literature about the frequently untoward and deleterious psychological side-effects of adrenocorticotrophic hormone (ACTH) and cortisone administration, this study attempts to investigate such effects in a controlled and thorough manner. Twenty-seven subjects were studied, undergoing extensive physical, neurological and psychological examinations through the treatment period. These were patients suffering from "intractable pain," defined as chronic, persistent and disabling pain of unknown etiology which had persisted for at least six months prior to the study and which had proved unresponsive to medical and/or surgical intervention. The majority of these patients bore the psychodiagnosis of conversion hysteria, a diagnosis confirmed by the psychological tests administered as part of the testing battery. The patients, divided randomly into experimental and control groups, received daily injections of maximally stimulating dose of ACTH and a placebo (similar in physical properties to the drug), respectively, for a fourteen-day experimental period. Four electroencephalographic records were taken during this time, and frequent electrocardiograms, blood chemistry studies and urinalyses were also made.

Psychological techniques for measuring reactions to ACTH divided into two groups: "External" and "internal" measurements. The former consisted of (a) an elaborate 37-item rating scale (the Northport Record for the Description of the Psychiatric Patient) on which a psychiatric nurse and a resident in psychiatry rated each of the patients both before and after the treatment period in terms of 37 psychiatric variables; (b) "Guessing" sheets, wherein the psychologist and the psychiatrists concerned with the patients made judgments after each contact with them as to whether the patient in question was receiving the drug or the placebo; and (c) the nurses' daily ward notes on each patient, taken verbatim. The purpose of the "external" measures was to obtain from trained clinicians pertinent data about the behavior of patients undergoing a profound alteration of body balance such as is caused by the potent ACTH.

The "internal" measurements consisted of five psychological tests in common use and a standardized clinical interview. These were administered at three points throughout the experimental period, classed as Days 1-5, Days 6-10, and Days 11-14, in order to trace progressive or cumulative effects of the drug as reflected in changing performances on each of the tests. The tests used were: one projective test, tapping "unconscious" levels of functioning – the Rorschach; two objective tests, tapping "conscious" levels – the Minnesota Multiphasic Personality Inventory and an adjective check list; and two situational tests, tapping "behavioral" levels – a level of inspiration task and a satiation task. Qualitative observations included the clinical interview and notes and observations made after each contact with the patients by the psychologist.

The research is based on the model of parallelism and interrelatedness of function of physiological and psychological processes. It hypothesizes that the psychopathology noted as a result of ACTH administration is a reflection of the organism's attempts to regain psychological homeostasis, attempts which parallel its re-gaining of physiological homeostasis after the imbalance effected by ACTH.

Analysis of the data yields the following results: (1) The ability of clinicians to differentiate experimentals from controls, or to assess significant aspects of deviant behavior engendered by ACTH is negligible and is noted on a chance basis only. (2) None of the psychological tests utilized yielded significant differences between experimentals and controls or between the progressive testing points within the experimental period. Some suggestive trends were noticed, however, although they are extremely tentative ones: (a) there seemed, in some cases, to occur more variability among experimental subjects in their test performances than occurred among control subjects; (b) some hints of increasing turbulence, primitivity and loss of intellectual and emotional control are seen in the experimental records; (c) a "reaction to hospitalization" is suggested as being causative of some of the psychopatholy seen, a reaction shared by experimentals and controls alike.

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CONDITIONING AND EXTINCTION OF A REFERENTIAL VERBAL RESPONSE CLASS IN A SITUATION RESEMBLING A CLINICAL DIAGNOSTIC INTERVIEW

(Publication No. 5861)

Sumaya Ahmad Fahmy, Ph.D.
Indiana University, 1953

The experiments reported here investigated a situation analogous with a simple conditioning and extinction experiment, but involving referential verbal behavior of human Ss. Specifically, the analogues were: As "conditioned stimuli," a set of inkblot cards; as "reinforcing stimuli," certain statements made by E; the response studied was the class of all statements made by the subject in which human beings were mentioned. The reinforcing statement was presented only when a member of this class of responses occurred.

In one experiment four groups, differentiated by the type of reinforcing statement made by E, were used. Following each mention of a human in the presence of an inkblot card, E said nothing to Ss in group I; said "That's a good one" to Ss in group II; repeated verbatim the response of the subject for Ss in

group III; and said "Give another one please" for Ss in group IV.

Twenty-two college students were run as subjects in each group for thirty learning trials. Ss were asked to report whatever they thought of when the card was presented and were instructed to give only one response to each card. Groups I, III, and IV did not differ significantly in the relative frequency with which members of the reinforced response class occurred. The Ss in group II gave the largest average relative frequency and this group differed reliably from the other three. Thirty-two per cent of the subjects in group II verbalized correctly the contingency between their responses and E's statement as compared with 9% in group IV, and none in group III. There was in group II only a slight tendency to give literal repetitions of earlier responses, but somewhat larger tendency toward a similarity in structure and reference from one response to another. Answers to a questionnaire on the reactions of the Ss to E's statement indicated that the reactions differed from group to group.

In a second experiment, extinction was investigated. There were two control groups. For 21 Ss, 80 trials were given on which E said nothing. For 22 Ss, 80 trials were given on which E said "That's a good one" after each mention of a human by S. For the 22 Ss in the experimental group, there were 40 trials on which E said "That's a good one," contingent upon the human response, followed by 40 trials on which E said nothing. There was no statistically significant evidence of a systematic decrease in the relative frequency of occurrence of the reinforced response during the extinction phase of the last group. It is possible that this is to be attributed to the fact that, although conditioning did occur in the acquisition phase, the differences between the "Good one" groups and control groups, while significant, were not large.

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A STUDY OF CHANGES IN PERSONAL ADJUSTMENT

(Publication No. 5828)

Searles A. Grossman, Ph.D.
University of Pennsylvania, 1950

This investigation dealt with discovering changes in personal adjustment of counselees while being counseled using the counselee-centered approach. Changes in expressed feelings regarding matters of concern and changes in adjustment in one problem-area which were accompanied by changes in other problem-areas were sought.

Six questions were posed:

1. Can differences be detected in the personal adjustment of counselees when counseling is carried on without benefit of diagnosis on the part of the counselor?

2. Can differences be detected in the personal adjustment of counselees which indicate that all of the counselee's concerns, such as might be classified into the seven problem-areas of social, school, job, sex, aims, adequacy, and parent, might be affected, regardless of whether or not these concerns were verbalized early in the counseling process?

3. Can the personal adjustment of counselees be estimated without the use of such methods as personality inventories and projective techniques?

4. Does the number of areas of concern to the counselee, such as might be classified into the seven problem-areas, differ as counseling proceeds?

5. Do the reasons given by a referral agency when a counselee is referred for adjustment counseling, turn out to be the chief problems to be solved?

6. Do any areas of expressed concern, such as might be classified into the seven problem areas, seem to be of expressed concern more often than other areas?

The counselee responses in certain of the counselee-centered, electrically recorded interviews of fifteen counselees were classified by three judges according to attitude and area of content. Agreement among judges as to the number of items correlated to an extent exceeding .90; the percentage of agreement as to similarity of classifications exceeded .85. The counselees whose interviews were studied were the first fifteen who applied for counseling; they had been referred because of difficulty in job or school programs.

The data revealed that the median per cents of responses classified by attitude decreased from beginning to closing to follow-up interviews; those classified as negative and ambivalent decreased. As counseling progressed, a decrease in tension was indicated. In answer to Question One, changes in adjustment were detected.

In eight instances as counseling closed, relief was expressed regarding difficulties hitherto not discussed. In answer to Question Two, differences were detected in adjustment of counselees indicating that all areas of concern were affected, regardless of whether or not they were expressed.

The follow-up interviews with the counselee, a member of his family, and his school or training supervisor indicated some relationship between counseling and differences in adjustment. It appears that personal adjustment can be estimated without using formal testing measures, in answer to Question Three.

Of the seven problem-areas — adequacy, aims, social, school, job, sex, and parent adjustment — each counselee expressed concerns classified into at least six, often seven. Concerning Question Four, the number of areas of expressed concern differed only slightly as counseling proceeded. However, attitudes expressed in general changed from negative and ambivalent to positive.

Regarding Question Five, although job or school adjustment were the bases for referral, no counselees indicated these as being areas of chief concern.

Generally, adequacy and aims adjustment appeared to be of most expressed concern; in all cases they were of considerable concern. In answer to Question

Six, these two areas appeared to be of most expressed concern.

The place of diagnosis in counselee-centered counseling was discussed; it was concluded that its function was more important in the counselor-centered approach. Individuals might be trained in counseling techniques without a long training period in diagnosis.

When indicated, adjustment counseling might facilitate vocational counseling and make the latter more fruitful. This might answer the need for learning activities offering individuals practice in problem-solving and decision-making. Studies involving larger samples and other approaches to counseling might make possible determinations of average increases and decreases in discomfort, typical adjustment profiles, and other generalizations.

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A STUDY OF THE DEVELOPMENT OF MOTOR ABILITIES BETWEEN THE AGES OF FOUR AND TWELVE, USING A MODIFICATION OF THE OSERETSKY SCALE

(Publication No. 5537)

Sarah Fitch Holbrook, Ph.D.
University of Minnesota, 1953

Problem

To investigate developmental aspects of motor ability in children by means of a modification of the Oseretsky Tests of Motor Proficiency and to standardize a motor scale, establishing tentative norms for its use with school age children.

Design and Sampling

1. Sampling: 40 children at each age level from four through twelve, equally divided between the sexes, representative of Minnesota population in socio-economic status as described in three broad groupings. Mean IQ 106. No gross physical or mental handicaps. Four year old group does not conform to the above sex or socio-economic controls.

2. Design: Following preliminary work in selecting, trying, and modifying items, the final scale was administered individually to the sample described above. Subjects tested within three months of their mid-birthdays. Records kept of individual performance and subjective observations of performance and general adjustment noted. Twenty nine-year-olds and twenty twelve-year-olds retested within a month for reliability. Twenty children at each of three age levels (five, seven, and nine years) retested after two years for determination of individual consistency and cross-checking of item placement.

Measuring Devices and Their Precision

The Oseretsky Tests of Motor Proficiency served as the basic instrument with three types of change: a few additions from other scales; some items dropped because of heavy intellectual or perceptual component, potential danger to subject, or lack of motivating power; changes in administration and directions. Final scale includes items in each of five categories described by Oseretsky: Speed, General Static Coordination, Simultaneous Movement, General Dynamic Coordination, Dynamic Manual Coordination. Items placed at age at which 50% of subjects succeed; performance curves of percent passing at each age level are shown. Re-test reliability for two age groups on separate subtests range from .83 to .96 when corrected for size of sample. Validity shown by increase with age in percent passing. Tables of intercorrelations between subtests presented; correlation with IQ, SE level, and sex shown.

Results

1. Items on final scale give satisfactory results on four indices of validity: ratio of successes in upper and lower half of age group; curves of percent passing the item; Cook's ID ratio (.60 to .96); and biserial correlations (.32 to .98).

2. Specific nature of subtests borne out by intercorrelation among them (.01 to .62).

3. Subtest intercorrelations are lower at age eight and above than at earlier ages.

4. Category of Speed shows more relationship to other categories; General Static Coordination shows less relationship to others.

5. Performance curves steepest between seven and ten, and level off at about eleven.

6. Difference between means of sample and check group significant at five year level, but not at later ages.

7. Individual consistency as measured by rank order correlation was .45 to .67.

8. No correlation found between motor performance and sex, IQ, or SE level.

9. No differences in efficiency between right and left handed subjects.

10. Extreme groups of well and poorly adjusted subjects differ significantly in motor performance, with well adjusted group superior.

Conclusions

Two major types of further study are needed: validation studies and the isolation of factors of motor ability. Learning and practice effect make measurement of motor performance a difficult procedure. Scale needs further work but in present form can be used to compare subject with others of his age group. May also be used with handicapped and mentally retarded children for purposes of planning training programs. Some evidence that motor performance is closely related to general adjustment.

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THE EFFECT OF PARTIAL REINFORCEMENT ON ACQUISITION AND EXTINCTION OF A CLASS OF VERBAL RESPONSES

(Publication No. 5868)

Frederick H. Kanfer, Ph.D.
Indiana University, 1953

The purpose of this study was to investigate the effect of partial reinforcement on the acquisition and extinction of a class of verbal responses in an autokinetic situation. Verbal reinforcing stimuli were used and reinforcement was contingent on the occurrence of a member of a specified response class.

129 volunteer undergraduates were randomly assigned to four groups, a 100%, 67%, 50% and 0% reinforcement group. All subjects were dark-adapted. They were then asked to estimate the extent of autokinetic movement of a light. By instructions, movement from two to thirteen inches was suggested. Each subject was given thirty trials and his estimates were recorded. During a rest period a "critical" class of responses for each subject was selected for reinforcement. The lower limit of this class always exceeded the numerical value of 70% of his initial thirty responses. The upper limit of the critical class exceeded the numerical value of 90% of his initial thirty responses. Thus, the critical class comprised consecutive numbers occurring less than 6/30 times in the initial sample.

During acquisition each subject's critical responses were followed by verbal reinforcement expressing accuracy of his estimates, according to the schedule of his group. After subjects in the 100%, 67%, and 50% groups reached a criterion of six critical responses in ten consecutive trials, extinction was begun. Subjects in the 0% group received thirty non-reinforced acquisition trials. All groups were given seventy five non-reinforced extinction trials.

A t-test on the number of critical responses in acquisition and during the last thirty extinction trials of the 0% group failed to show a significant difference. Thus, no adaptation effect operated in the situation.

During acquisition, the 100% group required significantly fewer trials but a greater number of reinforcements than the partial groups. The 50% group gave the greatest number of critical responses. Covariance analyses showed that the differences between groups were not due to differences in number of trials or reinforcements alone.

In extinction, the 67% group gave the greatest number of critical responses. The 100% group showed the greatest number of critical responses at the onset of extinction, followed by a sharp drop. The partial groups started with fewer critical responses but surpassed the 100% group as extinction progressed. The 50% group showed the least drop in critical responses during extinction. An F test on the ratios of critical responses during extinction trials 1-25/51-75 indicated that the changes in the number of critical responses during extinction differed significantly for the three groups. Covariance analyses suggested that extinction differences were not solely due to differences in trials and/or reinforcements during acquisition.

The results indicated that the general effects of partial reinforcement in a verbal situation which was analogous to operant conditioning procedures are similar to the findings obtained in classical conditioning with humans and in animal studies. Difficulties of experimental control of all variables operating during acquisition under partial reinforcement and the statistical methods of control employed in this study were discussed and the pertinent literature on partial reinforcement was reviewed.

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THE RELATIONSHIP BETWEEN DEPENDENCY FACTORS AND GOAL-SETTING BEHAVIOR IN DUODENAL ULCER PATIENTS

(Publication No. 5900)

Arthur Valentire Lamphere, Ph.D.
University of Washington, 1953

Many writers hold that peptic ulcer has important psychological components and a considerable amount of research and speculation has been directed toward determining the specific personality factors involved in this illness. A number of authorities assert that the primary personality characteristic of the ulcer patient is the presence of a dependency conflict. Some writers view the typical ulcer patient as reacting against his basic, underlying dependency by showing on the surface an exaggerated display of efficiency and independence. Others postulate that in addition to those ulcer patients who react against their dependency needs, there is also a group who are extremely passive and accept a dependent role. An earlier study by the writer showed a trend toward bi-modality in a distribution of scores obtained by ulcer patients on a measure of level of aspiration. This finding and its conformity with the theory that two types of reaction to dependency needs are characteristically found in a group of ulcer patients led to the present study.

This study was an attempt to confirm or deny the trend toward bi-modality in the goal-setting behavior of ulcer patients and to investigate the relationship between this behavior and conscious attitudes about dependency as reflected in self-descriptions. It was hypothesized that a group of ulcer patients would differ from a control group in the way in which they would describe themselves on a series of 96 statements judged to reflect dependent or independent behaviors or feelings.

The nature of the instrument used for measuring reaction dependency needs was such that in addition to obtaining scores on several variables, it was also possible to intercorrelate sortings of individuals and to factor analyze a matrix of these intercorrelations. This permitted the investigation of possible patterns of reactions which would differentiate the ulcer and control groups in the event that subtypes of ulcer patients had counterbalanced each other and thus

obscured actual differences between the two groups.

The results of the study indicated that the ulcer subjects tended to set significantly higher goals for themselves on the level of aspiration task than did the control group. The earlier study had shown only a slight, nonsignificant difference between an ulcer and control group on this measure. In the present study there was no evidence of the bi-modality observed in the earlier study. When the results of the two studies were combined, the difference in mean scores was not significant and the trend toward bi-modality was greatly reduced.

Scores obtained from the Dependency Scale were not related to goal-setting behavior. Only one score derived from the scale did tend to differentiate the groups. This score reflected a tendency on the part of the ulcer patients to endorse more frequently as self-descriptive the statements which expressed feeling rather than behavior. Analysis of this difference indicated that it was due to the tendency of ulcer patients to favor independent-feeling statements and to avoid independent-behavior statements more than did the control group subjects.

Preliminary results of the factor analysis indicated that four of the seven factors obtained by the analysis were differentially distributed between the ulcer and control groups. However, when efforts were made toward cross-validating these results by applying measures substantially correlated with the factor loadings, the differentiation was not reproducible. There was no indication in the factor analysis that any of the factors were associated with goal-setting behavior.

It was concluded from these results that the dependency conflict postulated for ulcer patients was not manifested to any marked degree in their performance on the measuring instruments used in this study. Thus the study gives little support to such a theory. The study emphasized the importance of cross-validating results obtained in psychological research.

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RELATIONSHIPS BETWEEN THE SELF CONCEPT AND DIFFERENCES IN THE STRENGTH AND GENERALITY OF ACHIEVEMENT MOTIVATION

(Publication No. 5702)

John George Martire, Ph.D.
University of Michigan, 1953

The primary purpose of this study was to investigate the nature of differences in Self concept among four groups of subjects classified according to strength and generality of achievement motivation. A subsidiary interest was to discover the relationships between level of aspiration concerning a specific achievement task and measures of both Self concept and achievement motivation.

The results of an exploratory study by Weinberger and previous work on the origins of achievement motivation provided some basis for the general hypothesis that people with strong generalized achievement motivation would show a discrepancy between Ideal Self and Actual Self ratings on five selected traits (Intelligence, Initiative, Creativeness, Motivation, General Success) judged to be instrumentally related to personal achievement.

Thematic apperception measures of achievement motivation were obtained for 53 male college students under both Relaxed and Achievement-motivating conditions. Ideal and Actual Self measures were obtained by having subjects rank 26 traits according to their importance and again in terms of how characteristic of them each trait was. Wishful and Realistic levels of aspiration were obtained for a specific pencil and paper task.

The general hypothesis was confirmed. Subjects who obtained high n Achievement scores under both Relaxed and Achievement-motivating conditions were found to have a significantly greater discrepancy between their Ideal and Actual Self ratings on the five achievement-related traits combined than subjects in three other categories. These other categories were also based upon measures of strength and generality of n Achievement.

Subjects having strong generalized achievement motivation but presumed to be also anxious about failure when in a stressful achievement situation, reported significantly lower Wishful and Realistic levels of aspiration for a specific task than other subjects.

While both Self concept and level of aspiration measures were meaningfully related to projective measures of achievement motivation, they could not be readily related to each other.

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AN EXPERIMENTAL STUDY OF REPRESSION

(Publication No. 5904)

Reed Miller Merrill, Ph.D.
University of Washington, 1953

The word association technique which is much used in clinical practice is based on the assumption that association disturbances on the test indicate that the stimulus words involved are associated with repressed, anxiety-related material. In accordance with repression theory as first developed by Freud it seems reasonable to predict that stimulus words with association disturbances would be more readily forgotten after a standard learning situation. A secondary prediction would be that words with association disturbances would be more difficult to learn. Another general phase of the experiment dealt with an experimental analogue of repression developed by Zeller in which an anxiety-producing interpolated task was viewed by Zeller as creating conditions leading to poorer recall and thus as analogous to repression.

These two variables, words with association disturbances and an anxiety-producing interpolated task, were the factors investigated in this study in relation to recall efficiency.

The hypotheses tested in the present study were:

1. There is no difference in the retention of words with association disturbances and words without association disturbances under similar interpolated task conditions. Secondary to this in this design, there is no difference in the number of trials required to learn to the same criterion words with and words without association disturbances.

2. There is no difference in the retention of words with association disturbances and words without association disturbances under anxiety or non-anxiety interpolated task conditions.

3. There is no difference in the retention of words with association disturbances and words without association disturbances after a non-anxiety interpolated task condition following an anxiety task condition.

Eighty freshmen and sophomore college males were given a 168-word association test. Ten words with association disturbances and ten words without association disturbances were selected for each Group E subject; all of these twenty words had to show no association disturbance for the paired Group C subject. These words were arranged in a list, each word being paired with a nonsense syllable. S learned to give the word in response to the nonsense syllable, the materials being presented to the S on an electrically driven memory drum. All S's learned to a criterion of one correct anticipation of the total list. Immediately following the learning different interpolated tasks were presented; half the S's received an anxiety-producing, half a non-anxiety-producing task. There were then four sub-groups of S's: (1) 20 S's with disturbing words and an anxiety-producing task; (2) 20 S's with disturbing words and a non-anxiety task; (3) 20 S's with neutral words and an anxiety-producing task, and (4) 20 S's with neutral words and a non-anxiety task. A free recall period (Recall I) of two minutes followed the 15 minute task period. All subjects then received a non-anxiety-producing task for 15 minutes. This was followed by a second, two-minute free recall period (Recall II). This completed the experiment.

It was found that disturbing words were not as well retained as neutral words. This finding supports the repression explanation of disturbances on the word association test. It was found that it did not take significantly more trials to learn disturbing words than to learn neutral words although the difference was in the direction that repression theory would predict; i.e., learning tended to be more difficult on disturbing than on neutral words. The experimenter feels that the learning criterion adopted by this experiment, which was primarily interested in retention, developed overlearning that masked the possible repression effect on learning.

The data supports the interpretation that an anxiety-producing interpolated task disturbs recall efficiency. Further, the interference effects of an anxiety-producing task are readily dissipated following a non-anxiety task.

The data do not support any multiplicative effect of disturbing words and anxiety-producing task on retention in this experimental setting. Various theoretical formulations are discussed and the findings finally viewed as evidence of the complicated interactional phenomenon confronting psychological experimentation.

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A STUDY OF THE FORMAL ASPECTS OF SCHIZOPHRENIC VERBAL COMMUNICATION

(Publication No. 5846)

Bernard Mirin, Ph.D.
Clark University, 1952

Although verbal communication has been recognized as one of the most important areas of schizophrenic language behavior, few experimental studies have been carried out in this field. It was the purpose of this study to make more precise the nature of the inadequacy of schizophrenic verbal communication.

The hypothesis advanced is that schizophrenics, as compared with normal adults, manifest a lower level of communication. Since one of the specific aims of the study is to investigate how autism is reflected in social speech behavior, a basic construct employed is the undifferentiatedness of inner and external speech.

The characteristic formal aspects of the schizophrenic's verbal communication were systematically investigated by creating a relatively structured communicative situation. The subject was told a short story and instructed to relate it to the interlocutor. The interlocutor, controlling the situation, purposely created an argumentative situation by disagreeing with the subject's story; they both were required to discuss these differences and arrive at an acceptable solution.

The subjects employed in the study consisted of two groups: (a) 30 male schizophrenics – ten hebephrenics, ten catatonics, and ten paranoids matched for age, I.Q., and education; (b) 20 normal males matched with the schizophrenics for age, I.Q., and education.

The two groups were compared with regard to three major aspects of verbal communication: Task Orientation; Social Reactivity; and Linguistic Thought. For the purpose of analysis three judges derived the initial categories from a preliminary inspection of the protocols. The empirically derived categories were then applied to the date by two independent judges.

The qualitative and quantitative analysis of the data yielded the following results:

a. Task Orientation. The schizophrenics, as compared with the normals, characteristically manifested a marked degree of lability with regard to their task orientation, i.e., they were unable to focus their behavior consistently on the task. Closely related to a labile task orientation was the concreteness of the symbolic activity of the schizophrenics, viz., they

were unable to assume the hypothetical attitude necessary for dealing with a task involving fictitious events.

b. Social Reactivity. Typically, the discussion of the schizophrenics, as compared with the flexible communicative behavior of the normals, largely remained unmodified in the interpersonal situation.

c. Linguistic Thought. The schizophrenics' verbal expressions of thinking, as compared with those of the normals, showed a certain degree of diffuseness and inarticulateness.

The findings suggest the following generalizations:

a. The communicative activity of the schizophrenic is formally different from that of the normal adult. The schizophrenic is obliged to communicate on a lower, socially undifferentiated level.

b. The hebephrenics evidence the greatest degree of undifferentiatedness in communicative activity due to their greater autistic involvement. Thus the catatonics and the paranoids are somewhat closer to the normals but show this difference with respect to each other: the catatonics tend to approximate normals more closely in their social behavior and task orientation whereas the paranoids tend to approximate normals more closely in their thinking.

The results of the study suggest that the undifferentiated communicative activity of the schizophrenic can be specifically related to the following hypothetical constructs: (1) the undifferentiatedness of inner and external speech; and (2) the inability to take the role of the "generalized other." With a heightening of autistic activity there is a lessening of the degree of differentiation between inner and external speech and between one's ego and his surrounding world.

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THE EFFECTS OF FAILURE ON GOAL-SETTING BEHAVIOR OF SCHIZOPHRENIC AND NORMAL SUBJECTS

(Publication No. 5929)

Ned Papania, Ph.D.
Michigan State College, 1953

The study concerned itself with the post failure goal setting behavior of a group of 32 mixed schizophrenics and a group of 32 "normal" subjects equated for age, education, intelligence and initial performance on the tasks to be used.

A level of aspiration setting was utilized for two tasks: (a) solution of simple addition problems (b) tweezer dexterity. These tasks were presented to the subjects as tests of intelligence and mechanical ability in order to "ego involve" them.

The two major groups were divided into two equated subgroups of 16 subjects. All four subgroups were given five practice trials on each task and five success trials during which they achieved their levels of aspiration.

From this point on the experiment consisted of a failure trial, in which level of aspiration was not achieved, followed by two success trials (referred to as post failure trials). This sequence was repeated five times for each task. The failure trials were differentiated into strong failure (in which only 50 per cent of the goal was reached) and mild failure (in which 90 per cent of the goal was reached).

Sixteen schizophrenic subjects and sixteen controls were exposed to strong failure, an equal number being exposed to mild failure.

Six variables were studied, viz: level of aspiration, discrepancy score, efficiency, reaction time, errors, and responses to questions asking for their subjective feelings after failure and success.

The hypotheses stated that after failure both schizophrenic groups should give higher levels of aspiration, higher discrepancy scores and longer reaction times than the controls. Further that they should show lower efficiency, greater error scores than the controls, and finally that they should attempt to deny subjective feelings of failure more frequently than the controls. Also, that the schizophrenics in strong failure should show these reactions to a greater extent than those in mild failure.

The data, analyzed by means of the one tailed t test, substantiate all of the hypotheses. The data further indicate that there is some behavioral disruption due to failure in the control strong failure group. Though they do not react as strongly as the schizophrenic groups, they do show a higher level of aspiration after failure than they did in success. They also show lower efficiency and greater reaction time. The above findings also apply when they are compared to the control mild failure group.

The findings are interpreted in accordance with Cameron's theory of reaction sensitivity to failure.

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THE PREDICTION OF CERTAIN ASPECTS OF THE PSYCHOTHERAPEUTIC RELATIONSHIP FROM RORSCHACH'S TEST: AN EMPIRICAL AND EXPLORATORY STUDY

(Publication No. 5725)

Stanley Fred Schneider, Ph.D.
University of Michigan, 1953

The purpose of this investigation is to predict important characteristics of the relationship between patient and therapist from Rorschach test data. The predictive measures are composed of configurations of Rorschach data which were objectified. The criterion measures are based upon the judgments of therapists on a 228 item questionnarie.

It was hypothesized that each of the following criterion variables (operating in the therapeutic relationship) could be predicted from Rorschach scores: Dependency, Hostility, Anxiety, Capacity for Free

Association, Acting Out, Isolation, Capacity for Transference and Ambivalence. Both predictive and criterion measures were derived from psychoanalytic theory, and the predictive measures were constructed so as to be congruent with Rorschach theory.

The subjects of the study were 56 adult, male outpatients who had received psychotherapy for at least six months at a V. A. Mental Hygiene Clinic. The criterion data were derived from the judgments of twelve therapists. Each therapist treated from three to six patients in the experimental population.

The criterion measures were derived by item analysis and subsequent factor analysis from the judgments of the therapists on the original questionnaire. Three primary factors emerging from this statistical treatment were: Transference, Anxiety and Free Association. Some evidence of the validity of all criterion measures was obtained from analyses of the correlations between them and global measures based upon ratings of patients' personality traits by the therapists. Two criterion variables, Isolation and Ambivalence, were eliminated from further consideration because they failed to demonstrate adequate validity.

Eight Rorschach measures were devised to test the hypotheses. Inter-judge scoring reliabilities were determined for selected and significant conventional Rorschach test factors and for certain qualitative factors. Weighted scores were obtained for each patient on each of the eight Rorschach measures.

Statistical tests of the hypotheses made by correlating Rorschach predictions with criterion measures were found to be significant in seven out of eight cases.

The results of this study indicate that meaningful aspects of the therapeutic relationship can be predicted from Rorschach configurations. This major finding and some of the supplementary findings indicate that the method holds promise for future investigation in the areas both of Rorschach methodology and the therapeutic process. Generalization of these findings may be made to other comparable populations, but should be guarded with respect to dissimilar situations.

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A STUDY OF THE RELATIONSHIPS BETWEEN OCULAR MUSCLE BALANCE AND CERTAIN INTELLIGENCE AND AUDITORY MEMORY VARIABLES

(Publication No. 5739)

Patricia Joyce Spaulding, Ph.D.
University of Michigan, 1953

This was a study of the relationship between faulty bi-foveal coordination, as determined by ocular muscle balance, and certain factors related to learning ability. Observations made by certain educators and ophthalmologists suggest that learning ability may be impaired in children with ocular muscle errors. Such observations are based almost entirely on children who have already shown evidences of academic disability, or who have consulted a medical specialist because they were experiencing visual discomfort. In general, no evidence is available regarding the children with muscle errors who are making adequate or superior progress in school: that is, who are well adjusted to their imbalance conditions.

The total student populations of two independent preparatory schools were studied. Each student received a complete ophthalmological examination, in which special emphasis was placed on muscle balance. Psychological tests administered included the Kuhlmann-Anderson group tests of intelligence and an individual auditory memory scale. Additional information obtained by the medical examiner provided a basis for classification of subjects in terms of behavioral manifestations often associated with visual disorders: e.g., frontal headaches, car-sickness, and excessive visual fatigue.

In the first section of the study, the data relative to the incidence of the several muscle imbalance conditions were investigated. In general, there were no significant differences in incidence of specific imbalance types from the junior high school to the senior high school age levels. Analysis of sex differences indicated that the girls tended to be superior on verbal tests, while the boys were significantly superior on numerical tasks.

The remainder of the study was based on the total group of muscle imbalance subjects from the two schools, and a control group matched with the imbalance subjects in terms of age, sex, and grade placement. Analysis of differences between the control group and the total combined imbalance group indicated that, in the few instances where significant differences were found, the abnormal muscle balance group tended to be superior. When specific homogeneous muscle balance groups were compared, somewhat more significant differences were found. In no case were the controls found to be significantly superior to the abnormal group.

A comparison of the groups classified in terms of the presence or absence of behavioral manifestations showed but few significant differences on psychological variables. These findings are interpreted as suggesting a possible temporal relationship between development of behavioral concomitants and ophthalmological treatment.

On the basis of these analyses, the major conclusion which may be drawn is that the hypothesis that lack of adequate bi-foveal coordination necessarily results in impairment of learning ability is not substantiated.

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AN EMPIRICAL INVESTIGATION OF THE LOSS OF SPELLING ABILITY IN DYSPHASICS

(Publication No. 5500)

John Ross Thurston, Ph.D.
State University of Iowa, 1953

The accumulation of empirical data concerning dysphasia is held to be a necessary first step in research which has as its goal the formulation of an all-embracing theoretical system that is necessary for a more complete understanding of dysphasia. The present study was designed to gather empirical data through an investigation and comparison of the oral spelling behavior of dysphasics, brain-damage patients and normal hospital patients.

A total of 30 dysphasics, 20 brain-damage patients and 60 normal patients were the subjects of this study. Each subject responded orally to a list of eighty spelling words so divided as to constitute four levels of increasing difficulty.

The following results were obtained from this study:

1. Dysphasics achieved an inferior performance on the spelling test as a whole when compared to normals and this inferiority was particularly marked on the more difficult words.

2. Low education, old age and poor general spelling ability reduced spelling performance in the same general manner (although not to the same extent) as dysphasia when the words become more difficult.

3. Comparison of dysphasics with Old normals, Low Education and Low Total score groups showed that the dysphasics were more inferior in oral spelling performance than any of these groups.

4. Brain-damage patients resembled the dysphasic group in total score but did not show the marked decrease in performance on the more difficult words that was noted in the case of the dysphasics.

5. The brain-damage group was inferior to the normal group at all levels of difficulty but the slope of the curve describing spelling ability at these levels was approximately the same for both groups.

6. When a high scoring group of dysphasics was matched within one point on List I score with a group of low scoring normals, it was found that the curves describing their performance could not be readily discriminated.

The results of this study are interpreted as indications that dysphasia results in a markedly decreased oral spelling performance which can be most adequately described as an extreme reduction in general spelling ability.

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PSYCHOLOGY: EXPERIMENTAL

VISUAL EGOCENTRIC LOCALIZATION: AN EXPERIMENTAL STUDY

(Publication No. 5836)

Jan H. Bruell, Ph.D.
Clark University, 1953

Egocentric localization was defined as localization of objects with respect to one's body. This study dealt with visual egocentric localization, specifically with the visual perception of the median plane.

In a historical introduction evidence was presented which showed that both retinal and muscular factors are determinants of visual egocentric localization. The need for a theory which would do away with the dichotomy of retinal vs. muscular factors was pointed out by referring to Werner and Wapner's views on these matters. A theory which stressed the interaction of both factors was proposed. Implications of this theory were tested in three experiments.

All three experiments were carried out in a darkroom. S's task was to fixate specified parts of a luminous oblong and to move the fixated part into his apparent median plane. The direction and magnitude of deviations of these adjustments from the objective median plane were measured. In the first two experiments, the distribution of retinal stimuli was varied by varying the extent of the test figure and the part of the figure fixated. The following main findings were made:

Direction of deviations: With fixation of the axis of symmetry of the test figure, the apparent median plane tended to coincide with the objective median plane. When a point left of the axis of symmetry was fixated, the apparent median plane deviated to the right; when a point to the right of the axis of symmetry was fixated the apparent median plane deviated to the left of the objective median plane.

Magnitude of deviations: When the vertical edge of the oblong was fixated the magnitude of the deviations increased with the width of the figure. With a given oblong the deviations were at their maximum when the edge of the test figure was fixated, at their minimum when the axis of symmetry was fixated.

In the third experiment changes in the tonic reflex system were created by having S fixate the left or right edge of a square while wearing an 8^{0} prism, base out, in front of the left or right eye. The apparent median plane deviated most to the left (most to the right) when the square extended left (right) of fixation and the prism was placed in front of the left (right) eye. The apparent median plane deviated least when the square extended left (right) of fixation and the prism was placed in front of the right (left) eye. The perceptual displacements suggested that retinal and muscular factors summate algebraically in determining the apparent median plane.

All observed deviations of the apparent median plane from the objective median plane confirmed deductions from the theory.

Also results of experiments dealing with the perception of the horizon were interpreted in terms of the theory.

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THE DEVELOPMENT AND LOSS OF A MUSCLE TENSION SET TO AN INCIDENTAL STIMULUS

(Publication No. 5862)

John Benson Fink, Ph.D.
Indiana University, 1953

The development of incidental motor sets is of considerable practical importance in the performance of complex motor tasks. Incidental motor sets acquired during the repeated performance of one motor task may very well interfere with or facilitate the performance or learning of another motor task. Consequently, it is pertinent to inquire into the development of incidental motor sets.

Evidence for the development of a muscle tension set to a stimulus antecedent to a response signal, and designated as antecedent by instruction, has been presented by various studies which have indicated that such a stimulus will evoke an appreciable muscle action potential increment.

The present study was concerned with the establishment of a muscle action potential set to an incidental stimulus about which S was not informed. Specifically, would an antecedent stimulus, which S was told would not occur, acquire the property of eliciting muscle action potential increments? If so, we might inquire into (1) relations obtaining between muscle action potential magnitude and overt response latency; and (2) acquisition and extinction characteristics of the muscle action potential set.

To investigate acquisition and extinction of a muscle tension set to an incidental stimulus, an experimental situation was modelled on the Pavlovian paradigm. Paired stimuli were utilized to obtain systematic modification of muscle action potentials preceding an instructed, overt response.

S was instructed to press a right-hand key to a high-pitched signal (H), a left-hand key to a low-pitched signal tone (L). S was informed that there would be a special warning tone (W) preceding H, but that no warning tone would precede L. Operating procedure was in accord with instructions, with the exceptions that for the Experimental group, a low level white noise (N) was presented contiguously prior to L; and for the Control group, N was presented one minute before L. H and L were tones of 1400 cps and 700 cps respectively, 70 db. level, and one-half second in duration. W was 1200 cps, 70 db. level, and two seconds in duration. N was 44 db. level, and two seconds in duration. Ten N-L trials were intermingled with ten W-H trials to constitute a 20 trial training series.

Measurements were obtained of left arm muscle action potentials during each half second of the white noise interval for the ten N-L trials, and for ten extinction trials in which only N was presented. An analysis of variance for repeated measures was used to evaluate time effects, trials effects, and time x trials interaction effects.

An inverse relation between muscle action potential magnitude and overt response latency, previously reported by Davis, was confirmed.

Significant acquisition and extinction effects were obtained.

It was concluded that incidental motor sets may develop in situations where some other response is occurring according to instruction; and that muscle tension sets show acquisition and extinction properties similar to those of overt behavioral phenomena.

Relations between this experimental situation and classical motor conditioning are discussed.

Since Fink and Davis in an earlier study have introduced the concept of a muscle action potential threshold, demonstrating that a muscle action potential level can be established above which an overt response will occur and below which it will not occur, it is suggested that overt motor response conditioning may be viewed as a consequence of muscle action potential conditioning.

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SCOTOPIC BRIGHTNESS DISCRIMINATION AS A FUNCTION OF PHOTORECEPTOR DENSITY

(Publication No. 5592)

Eugene Harrison Galanter, Ph.D.
University of Pennsylvania, 1953

Supervisor: William A. Shaw

The present research was undertaken to answer several questions concerning brightness discrimination at low intensity levels. First, we were interested in determining if the neural units to which Crozier refers in his theory of brightness discrimination were the sense cells of the retina. Second, we also wished to discover if spatial separation of the constant and variable stimulus lamps in a discrimination situation produces any effect on the size of the difference limen.

On the basis of Crozier's theory we would expect that wide separation of the stimulus lamps would produce a smaller DL than relatively close juxtaposition of the lamps. Compared to small separations, wide separations of the stimuli would impinge on dense rod areas of the retina. Such an outcome would serve to identify the neural units of the theory as the rods when the stimulating intensities are at low energy levels. However, Jacobs has shown that wide spatial separation at high intensity levels produce an increase in the DL, presumably because certain "cortical electrical gradients" decrease in slope as distance between stimulus sources increases. From these two points of view we must then predict opposing outcomes.

An experiment was conducted to test these hypotheses. This experiment consisted in measuring the precision of the psychometric function for brightness discrimination using the method of constant stimuli.

Nine subjects were tested under each of two experimental conditions, viz: large separation (39.5°) between stimulus lamps with the light impinging on dense receptor regions; and small separation (10°) between stimulus lamps with the light impinging on less dense receptor regions. The lights emitted energy in the photochromatic interval so that only rod action could occur. Monocular regard was employed, and all subjects underwent thirty minutes of dark adaptation. Each subject made 105 judgments under each condition.

The results indicate that for all nine subjects the precision was greater, i.e. the DL was smaller for the condition of wide separation between the stimulus lamps. Pooling the data for all subjects and fitting probits to the obtained points revealed statistically significant differences between the regression coefficients. For the large separation the "b" coefficient was .600 (S.E. = .02). For the small separation the "b" coefficient was .374 (S.E. = .02). These coefficients are in a ratio of 1.6 to 1.0 in the direction predicted by Crozier's theory when an additional assumption is made, namely that the neural units are the rods. The actual photoreceptor density differences between the two stimulated regions is 2 to 1 by Østerberg's histological count.

The discrepancy between the theoretical and the obtained ratios can be accounted for in several ways. First, the histological data may not be representative. Second, differences in training may produce non-random bias. Finally, some interaction between the mechanisms proposed by Crozier and by Jacobs may have been operating. The second possibility was investigated by examining the data from two of the more highly trained subjects. The ratios between the two conditions for these subjects were 2.1 to 1.0 and 2.15 to 1.0.

The theoretical implications of this research show that brilliance at low intensity levels is mediated by the number of receptors activated, and not by the rate of receptor discharge. This permits a new parameter to be considered as a possible mediator of frequency differences of the physical source at low intensity levels. Future research is suggested to verify this hypothesis.

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THE EFFECT OF EXTRANEOUS AUDITORY STIMULATION ON CRITICAL FLICKER FREQUENCY

(Publication No. 5838)

Robert Bryce Gorrell, Ph.D.
Clark University, 1953

The purpose of the present study was to investigate intersensory processes in normal adults, children, and brain-injured adults. The hypotheses tested and the interpretation of the results were based on organismic theory, with specific reference to the sensory-tonic field theory of perception and general genetic theory.

The methodology consisted of observing the effect of a low tone and a high tone (270 and 2400 cycles per second respectively) on critical flicker frequency. One of the basic assumptions of the study has been that tone should serve here as "extraneous stimulation," i.e., stimulation from a source other than the object: extraneous stimuli are assumed to affect the organismic ground, or, organismic frame of reference, against which objects are perceived. In the present study the object observed was a flickering light patch while the surrounding illumination constituted the ground. Changes in the object (critical flicker frequency) under conditions of tone were expected to occur because of the assumption that tone should influence the ground in a manner equivalent to changing the surrounding illumination.

Previous work with normal adults conducted at Clark University suggested that high tone has the effect of brightening the surrounding illumination to a greater degree than low tone; it was therefore hypothesized that here the condition of high tone should result in a lower critical flicker frequency than the condition of low tone. This was verified in a group of normal adults composed of 15 men and 15 women. It was further found that the effect of tone on critical flicker frequency was greater for men than for women. This result was consistent with previous work in intersensory relationships where such differential sensitivity of the sexes to "extraneous stimulation" had been noted.

The second part of the study was concerned with the problem of intersensory relationships in children. On the basis of genetic theory, it was expected that the greater homogeneity of perceptual organization in the younger children should lead to greater interaction of heteromodal factors constituting the organismic ground than with the older children.

Thus, a relatively greater effect of the tone on flicker perception was expected in the young children, decreasing with increasing age. The subjects used in testing this hypothesis were 180 children, six to eleven years old. There were 15 boys and 15 girls at each of the five successive age levels. The results were completely in accord with the expectation for males: the effect of tone in lowering the critical flicker frequency was greatest at the lowest age levels and decreased with age; in contrast, the differential effects of low versus high tone (high tone lowers critical flicker frequency to a greater degree than low tone) were smallest at the lowest age levels and increased with age. For females the results were less clear-cut: statistically significant effects of tone on critical flicker frequency occurred only at the later age levels; furthermore, as with the males, the greatest differential effects of low and high tone occurred at the later age levels.

The third part of this investigation was concerned with the problem of intersensory relationships in brain-injured adults. Basic to this study was the assumption that brain-injury results in an isolation of sub-systems. It was predicted that in brain-injured

patients such isolation would be reflected in a reduction of the effect of tone on critical flicker frequency, relative to a normal adult group. Thirty brain-injured patients were used to test this hypothesis, and the results found for this group were compared with those for the normal adult group. The hypothesis was confirmed, i.e., there was evidence that, compared with the normals, tone had less effect on critical flicker frequency in the brain-injured group. It was also found that the differential effect of high and low tone was less in the brain-injured than in the normal group.

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EFFECTS OF TRAINING UPON, AND RELATIONSHIPS BETWEEN, TWO STANDARD CHILD INTELLIGENCE TESTS

(Publication No. 5476)

Harold David Holloway, Ph.D.
State University of Iowa, 1953

The purposes of this experiment were: (a) to test four hypotheses concerning the effects of training upon Total and Full Scale IQ's as obtained by the Primary Mental Abilities-Primary (PMA) and the Wechsler Intelligence Scale for Children (WISC) respectively; and (b) to estimate relationships between the two tests. The training program was a commercial one written by Thelma Gwinn Thurstone.

The basic procedure was as follows: (a) Pre-training PMA and WISC IQ's were obtained for 124 subjects (mean CA, 5-6) enrolled in the kindergarten groups of each of four public schools in Iowa City, Iowa; (b) Training was administered by the teachers to two experimental groups but not to two control groups; and (c) Post-training PMA and WISC IQ's were obtained.

In Part I of the study, commensurate with purpose (a) above, a 2 x 2 factorial design (treatments x IQ levels) was employed to test the hypotheses where the criterion scores were the pre- to post-training IQ gains. Analyses of variance were computed for the PMA Total and WISC Full Scale IQ gains separately. The same 107 of the original 124 subjects were employed in each of the two analyses of variance. Only those subjects having complete pre- and posttest records on both tests qualified for use in the analyses of variance, thereby accounting for a loss of 17 subjects.

In Part II of the study, corresponding to purpose (b) above, multiple correlations were computed in which each of the WISC IQ's – Verbal (V), Performance (P), and Full Scale (FS) – served as a separate criterion to be predicted from a composite of five PMA subtest IQ's (excluding Total IQ). A total of 119 of the original 124 subjects possessed complete pre-training IQ's on both tests. They were combined into a single sample for the correlative analyses in which a procedure for deleting predictor variables was utilized. A total of ten multiple correlations resulted.

The principal findings for Part I were: (1) The means of the PMA IQ gains for the experimental groups were significantly higher than those for the corresponding control groups, but not in the case of the WISC IQ gains. (2) The analyses of variance results and the correlations between initial IQ and gains, for each test separately, did not support the hypothesis that subjects initially higher in PMA Total or WISC Full Scale IQ would gain significantly more than those initially lower. (3) The IQ gains were statistically significant on both tests for each individual group, with the exception of one PMA control group.

The main findings from Part II were: (1) Regardless of the criterion variable to be predicted (V, P, or FS), the multiple correlations were substantial in size, that is, in the .60's and .70's. (2) Considering the five PMA predictor variables, Verbal Meaning and Quantitative contributed the most to the criterion variance.

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SPONTANEOUS RECOVERY FROM EXTINCTION IN RELATION TO NUMBER OF REINFORCEMENTS, SPACING OF ACQUISITION, AND DURATION OF INITIAL EXTINCTION PERIOD

(Publication No. 5865)

Lloyd E. Homme, Ph.D.
Indiana University, 1953

Three experiments were reported investigating the theoretical and empirical relationships between spontaneous recovery from extinction and (a) number of reinforcements, (b) spacing of acquisition, and (c) duration of initial extinction period. All of the experiments utilized albino rats in a Skinner-type conditioning situation.

Experiment I. Effect of number of reinforcements. Four groups received 15, 50, 100, or 250 reinforcements on the same day, followed by 5 daily 60 minute extinction sessions. Predictions from Estes's statistical theory of learning were: (a) that the curves of day to day extinction totals for each group would be of the form, $R_m = -K \ln \left[1 - p_o \; j^{m-1} \right]$, where R_m is the total number of extinction responses on the mth day, K is a constant, p_o is the initial probability of responding on extinction, and j is a slope constant; (b) that the day to day curves of extinction totals would lie in order above one another without crossing, with the 15 reinforcement group the lowest and the 250 reinforcement group the highest; (c) that the curves would tend to converge as m increases, but would have the same relative slope; and (d) that initial probability of responding in extinction (p_o) would be an exponential function of number of reinforcements. It was concluded that the data offer considerable support for

predictions (a), (b), and (c); in connection with (d) it was found that, although p_0 did increase with number of reinforcements, the increase was smaller than predicted.

Experiment II. Effect of massed versus spaced acquisition. Two massed acquisition groups received 100 or 250 reinforcements on the same day; two experimental groups received 50 reinforcements on each of two days, or 50 reinforcements per day on each of 5 days. All groups received 5 daily 60 minute extinction sessions. Theoretical predictions were: (a) that the curves would be of the form mentioned above; (b) that the curves for day to day extinction totals for the spaced acquisition groups would like above those for massed acquisition; (c) that this effect would be greater in the case of 5 acquisition periods versus 1 than for 2 acquisition periods versus 1; (d) that the slope of the curves would be the same; (e) that initial probability of responding would be greater for the spaced groups; and (f) that the initial rates of responding during successive daily acquisition periods for the spaced groups would increase according to an exponential function.

Predicted relationships (a), (c), (d), (e), and (f) seem tenable; only the extended spacing group (50 x 5 reinforcements) showed differences from its control sufficient to support prediction (b).

Experiment III. The effect of duration of initial extinction period. Two control groups received 100 or 250 reinforcements in one session followed by five 60 minute extinction periods. Two experimental groups received the same treatment as the controls, except that the first extinction session was of only 10 minutes' duration. The predictions were (a) that the extinction totals on day 2 would be greater for the groups with the brief initial extinction periods and (b) that from extinction day 2 on, the curves would have higher initial rates, but the same slopes and forms as the control group curves. Mean differences between experimental and control groups were in the predicted direction, but not statistically significant. Prediction (b) was supported.

The most marked discrepancy between data and theory in all experiments, the magnitude of p_0, was discussed in relation to the random sampling of elements postulate. It was concluded that modifications of the theory may be necessary in this respect.

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TEMPORAL FACTORS IN RETROACTIVE INHIBITION: INFLUENCE OF LENGTH OF INTERVAL AND POINT AT WHICH INTERPOLATION OCCURS

(Publication No. 5510)

John Stapleton Howland, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor Leland E. Thune

The purpose of this study was to investigate retroactive inhibition as a function of the temporal point of insertion of the inhibitor under varying length of interval between the original learning and the measurement of retention. Four intervals were employed: 0.14, 1, 24 and 192 hour(s). For each interval, except the first, five points of interpolation were used: immediately after the original learning, one-fourth, one-half and three-fourths of the way between the original learning and remeasurement, and just before remeasurement. For the shortest interval, one point of interpolation occupied the entire interval. For each interval, there was also a control condition for which no learning was interpolated. There was a master control condition in which original learning was followed immediately by recall.

The usual retroactive inhibition paradigm was used with the original and interpolated lists related in the A-B, A-C manner. Lists were paired adjectives (ten pairs) and were presented on memory drums for eight trials each. Relearning was for at least eight trials or to original level. An unusual feature of the design was the employment of color guessing as a "warm-up" exercise for any learning series not immediately preceded by some other series.

Results were reported in terms of percentage retroactive inhibition as well as the number of overt intrusions from the interpolated list appearing during the recall of the original one. Both the number of correct responses during recall and the number of relearning trials to regain the original level of mastery served as a basis for computing retroactive inhibition. Both measures of retroactive inhibition were treated by an analysis of variance and the results showed very high agreement. Differences in inhibition due to the point of interpolation, length of interval, and the interaction of these two variables were found to be significant for recall scores, but point of interpolation did not quite reach significance for relearning scores.

The distributions of subjects giving overt intrusions as a function of length of interval and point of interpolation were found by a chi square test to differ reliably from chance. Analysis of overt intrusions showed that they did not vary directly with the amount of retroactive inhibition.

To account for the findings, two factors were assumed to be operative in the production of retroactive inhibition. The first of these, "differentiation," was assumed to be a direct function of the difference in age of the two response systems (original and interpolated learning) and to be represented by the overt intrusions. A second factor was designated "availability of the interpolated responses" and was postulated

as a direct function of the proximity of the interpolated learning to recall. It was assumed to act as a "screen" or "block" between the original responses and their reproduction. Findings were explained in terms of these factors. The inability of existing theories to satisfactorily explain those findings was pointed out.

From the results, it was concluded that: the point at which interpolation occurs is a factor in the production of retroactive inhibition but that such effect is not independent of the total time interval employed. No matter what the interval length, however, that point of interpolation just prior to recall produces the greatest amount of inhibition; no special importance is attached to that position just after original learning for all lengths of interval. In general, overt intrusions decrease as the interval length increases and as the interpolation occurs further and further away from the original learning. Overt intrusions, reflecting the competition among responses, do not always increase with an increased amount of inhibition and are thus assumed to account for only part of the interference. The residual is considered due to the too great availability of the interpolated responses at the time of recall which act to block recall of the original material.

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THE EFFECT OF HABIT FORMATION, MENTAL ACTIVITY, AND GROSS MUSCLE MOVEMENTS ON THE REPRODUCTION OF TIME

(Publication No. 5604)

John Raymond Kleiser, Ph.D.
University of Pennsylvania, 1953

Supervisor: Mortimer Garrison, Jr.

It was the purpose of this experiment to study the possibility of a relation between "time perception" as measured by the method of reproduction and the learning process. Design was such that it was possible to consider separately the motor and cognitive factors which were involved in the experimental task, card sorting. A secondary consideration was to investigate the effects of the prospect of the termination of practice upon time reproductions. It was hypothecated that concurrent with the increased proficiency time reproductions would become progressively longer.

Four groups of 20 male college students reproduced a series of fifteen 30 second intervals spent in one of the following four activities; dealing cards at increasing speeds as controlled by a metronome (increased motor activity with a minimum of cognitive activity); reading aloud (mental activity with a minimum of motor change); sorting cards with termination designation (learning with termination); sorting cards without designation (learning without termination).

The following conclusions were drawn:

1. As the learning of a card sorting task proceeds, reproductions of practice time come to be progressively larger.

2. A designation of termination has no significant effect upon the reproduction of time spent in this sort of learning.

3. Time reproductions of a repeated task in which there is mental activity but a minimum of motor change become progressively larger but to a lesser extent than in the case of progressive learning.

4. Time reproductions of a repeated task in which there is increased motor activity but a minimum of cognitive activity remain relatively constant.

5. Time reproductions of time spent in simple visual motor tasks are longer than of time spent in more complex tasks.

These results were interpreted as suggesting a lawful relationship between the assumed cognitive demand of the task and the resulting elevation and slope of fitted straight lines of repeated time reproductions. Relationship to previous experimental studies was discussed.

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CHANGES IN MUSCULAR TENSION AS A FUNCTION OF SUCCESS, FAILURE AND STATEMENTS OF HOPE AND EXPECTATION

(Publication No. 5607)

Saul S. Leshner, Ph.D.
University of Pennsylvania, 1953

Supervisor: William A. Shaw

Problem

The problem investigated was whether aspirations stated in realistic (expectant) terms exert a different influence on muscular tensions, as reflected by muscle action potentials, than irrealistically (hopefully) expressed aspirations, and whether such influence has a functional relationship with achievement reported to the individual as either success or failure. It was predicted that the realism of aspiration would interact with achievement to produce higher muscle tensions in individuals who stated expectations and failed, than in those who expressed aspirations hopefully and failed; tensions would decrease to lower levels for realistic Ss who succeeded than for irrealistic Ss who succeeded.

Procedure

Forty-eight college students were divided equally into four experimental groups, designated as Expect-Success, Hope-Success, Expect-Failure and Hope-Failure. Expect groups were instructed to state aspirations for a subsequent task in terms of scores they expected to achieve; Hope groups in terms of scores they hoped to obtain. Half of each group received a report of success for the task, and the other half received a failure report. The response observed was muscle action potentials taken from forearm muscles during physical relaxation throughout experimental treatment. The data was comprised of photographic records of MAP which had been amplified

and impressed upon an oscillograph. Experimental treatment consisted, in sequence, of a criterion rest period; a two minute rest following a statement of aspiration; work on a task involving mental solution of six figure pattern problems; rest following a report of achievement (success or failure); rest following a second aspiration stated in the same terms as in the first aspiration; and a second mental task of problems similar to, and equivalent in difficulty to the first task.

Results

It was found that muscular tensions are significantly higher following instruction to state a level of aspiration than during the preceding rest level. A marked tendency appeared for Hopeful aspirants to manifest greater muscular activity than those stating expectations. Tensions increased over both rest and aspiration levels when success or failure was reported to the individual. While no significant differences between the groups were obtained during rest as a result of success and failure, more variable responses were observed in the Hope-Failure group than in the other three groups. The second statement of aspiration produced no significant difference in tension levels between the experimental groups, but resulted in greater variability of response in the Expect-Failure than in the other groups. Tension levels were higher during mental work than during rest periods preceding and following instruction. Compared with the first task, tension levels during the second task were lowered by success and raised by failure. Analysis of variance of data obtained during the second task yielded a statistically significant interaction effect of aspiration and achievement. Tensions were significantly higher in Ss who stated expectations and failed than in those who stated irrealistic aspirations and failed; among successful Ss, tensions were higher for the irrealistic group. The results were interpreted as demonstrating that whatever influences are exerted upon muscular tensions by aspiration and achievement, they may not appear until the individual is engaged in work; and that the effect of the realism or irrealism of aspiration depends upon whether S has succeeded or failed. The hypothesis was confirmed by the results obtained.

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CONTROL INFORMATION AND FRAME OF REFERENCE

(Publication No. 5511)

Michel Loeb, Ph.D.
Vanderbilt University, 1953

Supervisor: Professor S. C. Ericksen

The purpose of the investigation was three-fold:

1. It was observed that some machines are designed to tell an operator the extent and direction of the correction he should make, while others are designed to show the extent and direction of error. The experiment was planned to determine (a) which arrangement is most effective and (b) if this varies according to the situation, how and in what manner the variation occurs.

2. It is noted that previous experiments usually used preference of relationship, rather than relative efficiency, as the criterion to determine which relationship is best. Accordingly, it was desired that this study indicate (a) what determines preference of response and (b) whether the preferred relationship is necessarily the most efficient.

3. It seemed apparent that in many cases an operator must shift from a machine that gives him correction information to one that gives him error information. It would be expected, on the basis of findings of various learning experiments, that associative interference effects would thereby result. It is believed that upon shifting from one display-response relationship to its opposite, appropriate verbal suggestions in terms of circumstances external to the immediate situation could cause the new relationship to be perceived as non-antagonistic to the old. If so, associative interference effects might be reduced.

Three experimental machines were utilized. Two, termed the "Dial" and the "Lights," had a stationary standard position and an indicator whose position could be altered by the subject. Seventy-two subjects were tested with both these devices in a counterbalanced order. An initial orientation in terms of an hypothetical external operation was suggested with both machines. Immediately afterward, subjects were allowed to express, overtly, a preference of display-response relationship. Next, subjects were instructed to work with a specific indicator-response arrangement. Necessary instructions were worded in terms of the hypothetical operating situation. After fifty trials, the experimenter mechanically reversed the relationship between indicator movement and response movement and attempted to correspondingly restructure the situation verbally in line with the shift in external frame of reference. Fifty trials were run under this orientation. Following this, a similar sequence, opposite in order of indicator-response relationships, was carried out with the other apparatus. The relative efficiency of the two types of relationship were noted for each device. Although 72 subjects were run on the "Lights" and "Dial," a mechanical breakdown made it necessary to analyze the performances of only the last 48 on the latter apparatus.

Twenty-three additional subjects were allowed to indicate overtly a preference on the "Lights" device without reference to any orientation in terms of external circumstances. Preferences of these subjects were compared with preferences of the subjects described above.

On the third device, the "Tracker" indicator positions were set automatically, and the standard or cursor was under the control of the subject. Twenty-two of the subjects, who used this machine, were run through a procedure very similar to that for the other devices. Twenty-six others were subjected to a

somewhat analogous procedure. These latter subjects, upon reversal, were simply told to shift their previous response habits, there being no verbal restructuring in terms of hypothetical external circumstances.

On the basis of preference and performance data obtained, the following conclusions were reached:

1. The most efficient apparatus arrangement involved movements of the apparatus component under the subject's control in the same direction as his response movement. It did not apparently matter whether this component was being used as an indicator or a standard. Subjects appeared to behave as if the apparatus were an extension of their persons, by which they manipulated the accessible apparatus components. They tended to react in the most concrete fashion, in terms of the situations immediately confronting them, rather than in a more abstract manner, in terms of the simulated practical circumstances to which the immediate stimuli supposedly referred.

2. The preferred relationship was not always more efficient than the non-preferred one. Apparently preference of relationship was a result of interaction between a subject's perception of the immediate situation and his perception of the hypothetical external situation.

3. There was no evidence that upon shifting from one relationship to another, verbal restructuring in terms of supposed external circumstances would prevent or reduce interference effects. There was some evidence that when the verbal suggestion did not fit in well with the subject's perception of the hypothetical situation, it might have a detrimental effect.

4. All the above conclusions should be checked experimentally, using other apparatus, situational components, and sensory modalities.

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AN INVESTIGATION OF VARIOUS FACTORS INFLUENCING THE SELECTION AND REPETITION OF WORDS PRESENTED DICHOTICALLY AT A SUPRA THRESHOLD LEVEL

(Publication No. 5551)

Paul Henry Ptacek, Ph.D.
University of Minnesota, 1953

Purpose

The purpose of this study was to investigate the influence of word length, word familiarity, and vowel intelligibility on the selection and repetition of words presented dichotically at a supra threshold level. More specifically, the problem was: Do the above mentioned factors affect a person's choice of a word when one word is presented to one ear and a different word is presented to the other ear at the same time?

Procedure

Two separate investigations were conducted, a preliminary one with 30 subjects, and a major one with 40 subjects. The age range of the subjects was from 14 to 49. Essentially the same equipment and procedure was used in both investigations.

Since three variables were being studied, the experimental plan was to hold two of the variables constant while varying the third. In other words, in one third of the pairs of words presented, vowel intelligibility and word familiarity were held constant while word length was varied; in another third of the pairs of words vowel intelligibility and word length were held constant while word familiarity was varied, and in the remaining third of the pairs of words, length and familiarity were held constant while vowel intelligibility was varied. The measures of the variables used were as follows; familiarity was determined from the Thorndike-Lorge word count, length was measured by counting the syllables (all words were monosyllables except the longer words which were disyllables), and the measure of vowel intelligibility was derived from Fletcher's data on the number of times the various speech sounds are misinterpreted. After the test words were selected, they were paired off in a manner which insured that an equal number of the longer words, more familiar words, and words having greater vowel intelligibility would be presented to each ear of the subject. The pairs of the words were randomized for determining the order of presentation to the subjects.

The equipment used consisted of two tape recorders modified to permit separate recordings on the upper and lower halves of a magnetic tape. The words recorded in this manner were played back so that one word was presented to one ear and another word was presented to the other ear simultaneously $\pm$16.6 milliseconds. A pair of words was presented to the subject approximately every three seconds and he was asked to select and repeat aloud one word from each pair of words presented.

Results

Longer words and more familiar words were selected a significantly greater number of times than shorter words and less familiar words. The Sign Test and Chi Square Tests reached convincing levels of significance in the cases of the longer words and the more familiar words. The vowel intelligibility category failed to show significance.

Since there were two separate studies with essentially the same equipment and procedure, one study was considered a replication of the other, and the probability of getting the results obtained in the separate studies was calculated. In the case of varied length this probability was .0001, and in the case of varied familiarity the probability was .004. Because the vowel intelligibility category failed to show consistency in the direction of the choices, computing the probability was not feasible.

Conclusions

Within the limitations of the experiment, the following conclusions are offered. Length and familiarity

are significant factors in the selection and repetition of words presented dichotically at the supra threshold level. Vowel intelligibility does not appear to be a significant factor. Those factors which through previous investigations have been found to be important in determining word intelligibility also seem to be important in the selection of words presented dichotically.

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THE EFFECTS OF DIFFERENTIAL REINFORCEMENT PATTERNS ON CERTAINTY OF PREDICTION UNDER TWO LEVELS OF MOTIVATION

(Publication No. 5495)

Sidney Rosenblum, Ph.D.
State University of Iowa, 1953

This research was devised primarily as a contribution to the understanding of the effects of differential reinforcement patterns in combination with various motivational conditions on the behavior of children. Specifically, it was formulated to investigate the acquisition and extinction of a response, namely, the degree of certainty with which a child makes a prediction concerning the occurrence of a success experience for himself, under 3 schedules of reinforcement (100 per cent, 50 per cent, and 0 per cent) and 2 levels of motivation (high and low).

One hundred twenty normal 4th and 5th grade children were assigned randomly to 3 major reinforcement groups, and again divided into 6 motivational sub-groups. Group I (100 per cent) was administered a series of continuous positive reinforcements during trials 1 through 10, followed by an extinction series of 10 non-reinforced trials; Group II (50 per cent) received positive reinforcement on only 5 randomly selected trials during acquisition, followed by 10 extinction trials; and Group III (0 per cent) received a continuous series of 20 non-reinforced trials.

Each subject, seen individually, was presented with a "game" involving the copying of a series of 20 geometric designs. Before starting, he was informed that 1 of 3 possible events would occur after the completion of each individual drawing, the receipt of a plus, a minus, or nothing at all. Before copying each design he was instructed to "make a bet" from a pile of 15 red poker chips to indicate how certain he was of the occurrence of a success experience for himself (i.e., the receipt of a plus). Any number of chips from 0 to 15 could be bet; zero indicating a success prediction of least and 15 a success prediction of most certainty. Nothing was won or lost with these chips; they were introduced solely as a non-verbal technique of obtaining a child's certainty of prediction responses (CPR's), and of getting him to do some "subjective scaling" regarding each bet made. All subjects in "High Motivation" subgroups were provided, additionally, with a set of specially prepared "ego-involving" instructions intended to induce a state of drive. No such instructions were read to the "Low Motivation" subjects.

The criterion measures used in statistical analyses were the numbers of poker chips bet by each subject to indicate the degree of certainty with which he made a prediction of success for himself on each of the 20 trials constituting the experimental session. Analyses of acquisition data revealed: (1) statistically significant acquisition trends from trials 1 to 10 under all 3 reinforcement schedules (100 per cent, 50 per cent, 0 per cent); (2) significantly greater increments in mean CPR's under 100 per cent than 50 per cent or 0 per cent reinforcement, but no significant observable differences between the 50 per cent or 0 per cent patterns; and (3) no statistically significant differences between the high and low motivation groupings. Extinction data yielded no concrete support for the hypothesis predicting a significantly greater extinction rate in mean CPR's for the 100 per cent group than for either the 50 per cent or 0 per cent groups. Nor were any reliable differences noted in the effects of motivational conditions. On a priori grounds a test for the presence of a simple 100 per cent extinction trend was made and proved significant. This finding, however, is considered equivocal.

In general, results yielded by the acquisition data are considered consistent with the findings of continuous and partial reinforcement research (using animals and adult humans as subjects) of somewhat more rapid acquisition of behavior under continuous than partial reinforcement. Though lacking statistical significance, results of the 100 per cent and 50 per cent extinction data are in the same direction as the general conclusion reached in these same studies indicating greater resistance to extinction occurring when behavior has been acquired under a schedule of partial as compared to continuous reinforcement.

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SOME EFFECTS OF MANIFEST ANXIETY AND SYMBOLIC REWARD AND PUNISHMENT ON LEARNING AND STIMULUS GENERALIZATION OF COMPLEX VISUAL MATERIAL

(Publication No. 5909)

Donald Phillip Schmidt, Ph.D.
University of Washington, 1953

This experiment was designed to test certain questions arising from Dollard and Miller's formulation of anxiety as a drive by studying the effects of anxiety and learning conditions on learning and stimulus generalization. It was assumed that Miller and Dollard's definition of anxiety is related to manifest or response-defined anxiety. It was hypothesized that higher levels of manifest anxiety would lead to greater learning in a fixed number of trials under conditions

of symbolic reward or symbolic punishment, and the performance of the punished groups would be superior to that of the rewarded groups. It was also hypothesized that manifest anxiety and symbolic punishment, by increasing total effective drive strength, would increase stimulus generalization responses to complex visual material.

Forty subjects were selected on the basis of extreme scores on a scale of manifest anxiety. High and low manifest anxiety groups were randomly subdivided into two subgroups of ten each, to be trained under conditions of symbolic reward and punishment. The symbolic reward was a green light flashed whenever the subjects responded correctly. Symbolic punishment was administered by sounding a buzzer for errors. An anticipation method of learning to associate meaningful words with a list of 18 nonsense geometrical figures was used. The list was presented five times in different orders. On the test trial, one week later, the subjects were tested on a series including the original figures, two figures similar to each original, and one dissimilar figure for each original. Responses to the similar figures with the words learned for the original figures were taken as a measure of stimulus generalization.

With respect to stimulus generalization, the results were equivocal. Although three of the four groups generalized as was predicted, the expected differences between these groups were not found. The high manifest anxiety rewarded and punished groups, and the punished low manifest anxiety group all generalized reliably more than the rewarded low manifest anxiety group. Possible explanations were offered in terms of differential response to the learning conditions as a function of manifest anxiety level and in terms of the possibility that subjects with a high level of manifest anxiety have a response potential at or near a theoretical maximum when habit strengths are equal to those of subjects with a low level of manifest anxiety.

Differences in level of manifest anxiety were not reflected in differences in learning. This was contrary to our expectation. It was suggested that the characteristics of the learning materials, in terms of low intra-list similarity and low association value between figures and words, could account for these results.

The findings were discussed in the light of related experiments and possibilities for future research. It was suggested that further research may profitably deal with anxiety in terms of its function as a relevant or irrelevant drive, depending on the situation in which it occurs.

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SEX DIFFERENCES IN FORMING IMPRESSIONS OF PERSONALITY

(Publication No. 5625)

John Summerskill, Ph.D.
University of Pennsylvania, 1953

Supervisor: R. A. Brotemande

The experiment was designed to investigate sex influences upon reported impressions of personality. Groups of men and women observers were shown a male and female stimulus person by means of motion picture film. The observer sample of 200 college students included 100 men and 100 women and was controlled with respect to age, marital status, order of stimulus person presentation, and order of response items. The stimulus persons were presented to 50% of the observers with the film sound track in operation and to 50% of the observers without the sound track. Observers reported impressions of personality by immediately filling out questionnaires developed in preliminary research through open-ended interviewing about stimulus persons. The questionnaires contained seven sections including a space for recording verbatim impressions, a trait check list, and a series of rating scales.

Results show that the occurrence of differences in impressions by men and women observers invariably depend upon the nature of existing stimulus conditions. Under certain conditions, impressions by women were found to contain a greater number of words, a greater number of unfavorable traits, and a greater degree of moral censure. The impressions formed by men and women of a person of the same sex contained a greater number of words than impressions of a person of the opposite sex. Under specified stimulus conditions men and women differed in response to items dealing with affective reaction to stimulus persons, and in response to a question concerning the feelings of others towards the stimulus persons. There were no significant differences between men and women in regard to preferred closeness of association with the stimulus persons presented.

It was established that men and women observers agree on traits which are most descriptive of stimulus persons, but differ significantly in attribution of some other traits to these persons. These differences were expressed in frequency of response to some check list traits and in judgments on the degree of relevancy of some descriptive statements about those observed. This sex difference in the configuration of impressions can be schematically represented as follows: when women characterize a person as X!-Y-Z-a-b, men characterize the same person as X-Y!-Z-c-d.

The results are interpreted in terms of sex differences in expectancies about the behavior of others which are seen to arise in differences in conceptions of male and female roles. Sex differences in content of impressions are considered predictable from knowledge of socially prescribed roles. Obtained differences in content are related in the discussion of results to various expectancies, postulated from available description of sex roles.

The assumption that impressions of personality

represent a product of interaction between stimulus and observer factors was corroborated by the results.

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A STUDY OF THE SEVERITY OF THE INDIVIDUAL MOMENTS OF STUTTERING UNDER THE CONDITIONS OF SUCCESSIVE READINGS OF THE SAME MATERIAL

(Publication No. 5502)

William David Trotter, Ph.D.
State University of Iowa, 1953

The general purpose of the present study was to investigate variation in the severity of stuttering on the individual stuttered words under the condition of successive readings of the same material. Two main problems studied were: (1) the course of the severity of stuttering during five successive readings of the same passage when severity is measured in terms of the mean severity of stuttering on the stuttered words as determined by psychological scaling; and (2) the relationship between the number of times a word is stuttered in five successive readings of the same passage and the mean scaled severity of stuttering on the word. It was also part of the plan of this investigation: (1) to determine whether there is a functional relationship between the weights of words, according to Brown's criteria, and the variable of severity of stuttering on the words; and (2) to obtain an estimate of the correlation between two measures of the severity of stuttering, one based upon the frequency of occurrence of stuttering and the other based upon the mean scaled severity of stuttering on the stuttered words.

Five successive readings of a 500-word passage for each of 20 stutterers were tape-recorded. The 100 recordings were randomized. The recordings were played back twice to two judges, working independently, who marked what they believed to be the moments of stuttering. Any word that was marked at least twice out of the possible four times was regarded, for the purposes of this experiment, as a stuttered word. The recordings were played back to a group of observers consisting of 11 speech pathology students enrolled in a course in stuttering therapy and theory. They judged the severity of each individual moment of stuttering through an application of the method of equal-appearing intervals employing a nine-point scale extending from one, for least severe stuttering, to nine, for most severe stuttering. The judges received training and had practice in rating the severity of individual moments of stuttering prior to the experimental rating sessions.

For each of the 8,484 stuttered words a mean severity level was calculated from the judgments of the raters. Criterion measures appropriate to the various analyses of trends of severity were computed by averaging the mean severity levels of the individual stutterings for each subject for each condition under each analysis. An analysis of variance technique was used to evaluate the obtained differences.

On the basis of the results obtained, the following statements may be made:

1. There is significantly more severe stuttering, in terms of the mean severity of the individual moments of stuttering, on reading one than on any subsequent reading.
2. The words stuttered more often during the course of the five readings are, in general, the more severely stuttered words.
3. The trend of severity on the stuttered words is significant when the words are classified to Brown's word weights. In general, an increase in the weight of the words is accompanied by an increase in the severity of stuttering.
4. The estimated value of the correlation between the two measures of the severity of stuttering is .61. The relationship between the two measures tends to remain the same from reading to reading, both for the group considered as a whole and for the individuals comprising the group.

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PITCH SHIFTS AS THEY RELATE TO HEARING LOSSES CAUSED BY SIMULTANEOUS MASKING

(Publication No. 5503)

John Cross Webster, Ph.D.
State University of Iowa, 1953

A method was developed for getting a continuous and running record of pitch matches between the two ears over a frequency extent of one octave. The automatic recording audiometer, usually referred to as a "Bekesy" audiometer, measures hearing loss (amount of attenuation) as a continuous function of frequency. By using the automatic frequency and paper drive features of the Iowa version of the "Bekesy" audiometer but using the subject's adjustment of a second oscillator, instead of an attenuator, to drive the recording pen, a continuous tracing of pitch matches is available. A one-second tone from the motor driven (standard) oscillator (controlling the paper drive) is presented to one ear and a two-second tone from the subject's (variable) oscillator (controlling the pen writing mechanism) is presented alternately to the other ear. Between successive presentations of the standard tone its frequency is shifted continuously upward in increments of 0.77%. The listener, who controls the frequency of the variable tone, is instructed to keep the two alternating tones matched in pitch. In this manner 90 distinct pitch matches are made in each octave and a permanent record of the frequencies of the two oscillators is available.

Ten music students made these pitch matches over

the six-octave interval from 150-9600 cps. In the ear in which the standard tone was heard various types and amounts of hearing loss were simulated by masking noises. Results indicate a correlation between the slope of the hearing loss and the amount and direction of the pitch shift. The pitch tends to shift away from a region of hearing loss to a region of no, or less, hearing loss. Downward shifts in pitch were observed but were never as marked as the upward shifts.

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AN EXPERIMENTAL AND THEORETICAL ANALYSIS OF PLACE LEARNING

(Publication No. 5631)

John D. Werntz, Ph.D.
University of Pennsylvania, 1953

Supervisor: William A. Shaw

The experiment was designed to permit a test between S-R and place learning in an experimental situation providing a heterogeneous visual environment and wide latitude for exploration during training.

Twenty young male hooded rats were assigned at random to E and C groups. There were 12 E and 8 C Ss. E and C Ss, running under 21 hours food deprivation, were given 12 spaced trials, two per night, on a hexagonal tabletop with a large trefoil shaped hole in its center. Ss were started from one of two corners, 120 degrees apart, in a predetermined random order. Food reward was available in a recessed slot in the corner of the tabletop equidistant from the starting places. On all tabletop trials, with the exception of the tenth and twelfth, glass barriers were placed on the tabletop. These barriers forced S to skirt two sides of the three-sided hole in the tabletop in order to reach the goal. The tenth and twelfth trials were test trials. On these trials, the glass barriers were removed. S was thereby permitted to approach the goal along any sector of the tabletop, including that area previously interdicted to him by the barriers on all previous trials from that starting place. Treatment of E and C Ss was identical except that C Ss were run with a black curtain completely surrounding the tabletop. This curtain cut off all surrounding objects from the vision of C Ss. The surroundings of the tabletop provided E Ss with a wide variety of visual cues.

Following completion of tabletop trials, both groups were run on an elevated maze in the same room. The maze was in the form of a hexagon with an inscribed equilateral triangle. The maze had two starting platforms at corners 120 degrees apart, and a goal platform at the corner equidistant from the starting platforms. The maze was situated in the experimental room such that the location in the room of the food-slot in the goal platform coincided precisely with that of the food-slot on the tabletop. The initial choice points to which the two starting platforms led were positioned in the locations previously occupied by the starting places on the tabletop. All Ss were given two trials per night for six nights on this maze, with random alternation of starting place. Trials were spaced. Ss ran under 21 hours food deprivation and were rewarded with food. The correction method was employed on maze trials. All Ss ran in the heterogeneous extra-maze environment with the black curtain raised.

On barrier-free tabletop trials, a significantly larger proportion of E than of C Ss ran directly to the goal, despite their having been trained on a circuitous route. On the first night of maze trials, a significantly larger proportion of E than of C Ss ran to the goal along the direct maze paths. In overall maze performance, the number of Direct runs by the E group was significantly greater than the number of Direct runs by the C group. These data were interpreted as supporting a cognitive, or place-learning, rather than an S-R view of spatial learning.

A critique of the major current theoretical account of place learning was offered, and a new theoretical statement was advanced. Results of one previous experiment in the place-learning field and of the present experiment were discussed in terms of the present writer's theoretical framework.

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AN EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF FIELD CONDITIONS ON VERBALIZATIONS

(Publication No. 5632)

Joseph Frank Whiting, Ph.D.
University of Pennsylvania, 1953

Supervisor: Mortimer Garrison, Jr.

The present experiment was designed to test two differing views about projective techniques: viz., that, on the one hand, the response to projective techniques is a function of the individual's personality; and, on the other hand, that the response to projective techniques is a complex function of the person and the environmental situation in which he responds. The literature was briefly reviewed with special reference to previous work on the Thematic Apperception Test and the conclusion was drawn that, while the former view noted above is the more popular one in clinical research on the T.A.T. and other projective techniques, the latter view is more acceptable from the point of view of experimental psychology.

On the basis of the evidence presented by a number of studies concerned with the formal characteristics of the T.A.T. stories, and the writer's agreement with the latter of the two above-mentioned points of view, the following experimental hypothesis was

formulated: "The individual's verbal response is a function of the stimulus structurization and of the instructions." In order to test this hypothesis, an experiment using factorial design was formulated utilizing three different types of instructions and four different degrees of stimulus structurization. The measure of the dependent variable of verbal behavior consisted of a count of the total number of words elicited in each story told under the various instructions and stimulus structure conditions.

The data were analysed by the analysis of variance and by the use of the Wilcoxon T test, a non-parametric technique. On the basis of these analyses the following major conclusions were drawn: (1) Verbal productivity varies as a function of the degree of stimulus structure. This function is curvilinear in form. (2) Variation in instructions appears to have little or no effect on verbal productivity. These results were discussed and suggestions for future research were made.

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AN INVESTIGATION OF THE CONCEPT OF CERTAINTY IN HUMAN BEHAVIOR

(Publication No. 5820)

Wirt McCoy Wolff, Ph.D.
Stanford University, 1953

This investigation views "psychological certainty" as the personal conviction one has about his behavior and its anticipated consequences. It is reflected in expressions of subjective certainty and in the amount of information requested before making a choice in a situation.

This investigation was stimulated in a general way by the current interest within psychology in attempts to cut across its various subdivisions for more understanding of behavior and experience. It seemed that concepts of certainty were often used in various subdivisions of psychology as well as in their overlapping areas. This seemed especially so for the areas of personality and learning. The frequent appearances of certainty and the relative lack of direct studies of the concept indicated the need for relevant research.

The appearance of certainty in different personality and learning theories was discussed and pertinent studies were reviewed. The main problem studied was that of the generality of certainty measures obtained from divergent kinds of behavior. The measures used had acceptable reliability and face validity, but only two of the twenty interrelations among certainty measures were statistically significant. The frequent negative results cast doubt upon any use of a general concept of certainty. Consequently, psychological theories are questionable when they utilize a broad concept of certainty. These results do not offer great hope that concepts of certainty might aid in a rapproachment of different psychological fields since the concept does not exhibit much generality.

A subsidiary problem of the relationship between certainty and anxiety was studied because of the importance of these concepts in personality and because of a frequent contention that anxiety and lack of certainty are associated. The only significant relationships found were inverse ones between a self-sufficiency measure of certainty and a measure of anxiety. Both of these measures were derived from Minnesota Multiphasic Personality Inventory items so there is evidence for the association of anxiety and lack of certainty when they are measured by different scales of the same paper and pencil device. No other significant interrelationships were found among the fourteen studied. The negative results obtained cast doubt upon the assumption that any broad association between anxiety and lack of certainty exists.

A subsidiary problem of the relationship between certainty and learning rate was studied because of the controversial opinions about the expected relationship. The writer postulated a positive relationship. The results indicated no significant relationships between certainty measures obtained outside the learning situation and the learning rate of paired-associates material. However, the certainty measure obtained within the learning situation was highly and positively related to learning rate. These results indicate no general relationship between certainty and learning, but they do reflect a significant positive relationship between certainty and learning within the learning situation.

A derived hypothesis was studied as an approach to a kind of learning perhaps more relevant to every day learning behavior where one's learning and certainty are both explicitly validated. This hypothesis was formulated as follows: the added opportunity to validate certainty explicitly during learning will facilitate learning rate. The results were not statistically significant but the experimental-choice group did show the expected superiority in learning rate to the control-rote group. This learning procedure seems worthy of further study.

These are reliable and valid findings for the concept of psychological certainty as measured in this study. The results are germane to psychology in that they indicate the necessity for revisions of theories using generalized concepts of certainty. Theories positing comprehensive relationships between certainty and anxiety and between certainty and learning are especially in need of revision.

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THE PLACE OF REASON IN THE THEOLOGY OF JOHN WESLEY

(Publication No. 5509)

Wallace Gale Gray, Jr., Ph.D.
Vanderbilt University, 1953

Supervisor: Edward T. Ramsdell

Wesley emphatically stated that reason had an important place in theology. The question is what he thought that place should be. There are certain antitheses in his thought which he did not always seem to recognize. The most important of these have at least implicit resolutions.

Wesley sought to occupy a moderate position with regard to reason. The impression that he was an antirationalist may well have arisen in connection with his close work with the common people. It may have been strengthened by his frequent impatience with disinterested or speculative inquiry (Chap. I).

He believed that scientific and philosophic investigations can be fruitful in terms of their own objectives and yet harmful from the standpoint of man's relationship to God. Wesley's intellectual interests included such varied disciplines as logic, astronomy, physics, and biology. He probably had a much stronger inclination toward the theoretical and speculative than he could either recognize or justify. Orthodoxy may have prevented his "evolutionary" phrases from being much more than rhetorical, but it did not prevent him from having keen insights concerning the psychosomatic character of many medical problems (Chap. II).

For Wesley, God's prevenient grace enables all of the willing to know something about Him from His works, but such knowledge, while significant as preparation for fuller light, is not saving knowledge for those who have heard the Gospel. God makes saving knowledge possible through the Church; faith is thus socially and sacramentally conditioned.

Wesley's vivid description of the widespread ignorance of mankind applies chiefly to morality and religion; reason, he believes, has been given comparative independence and competence in the secular affairs of life. However, this competence is considerably less evident apart from the influence of Christianity (Chap. III).

The Bible is the only book in religion but not in science. Even in religion it is elucidated by other books as well as by reason and experience. The need for explicit revelation is answered in the Bible, but the different parts of the Bible are of varying degrees of importance. Importance is proportionate to clarity and nearness to the heart of the Gospel (the love of God). But the meaning and relevance of Biblical passages is best realized in and checked by experience (Chap. IV).

The chief functions of reason in relation to general experience are to receive, to infer from, to regulate, and to wonder. The Bible, reason, and experience act as checks and balances upon each other in reference to religious knowledge. There is some overlapping of province but each "check" has its distinct theological function. The Bible objectifies religious truth, and experience personalizes it. In both cases the meanings involved are capable of manipulation and communication (but not reduction) by reason (Chap. V).

Disagreement is one result of the limitations of reason. The means of dealing with the problem of disagreement (humility, honesty, tolerance, and love), while largely matters of the volitional and affective life, are nevertheless in accord with reason insofar as it is repelled by their opposites – pride, duplicity, intolerance, and hatred (Chap. VI).

Wesley underwent at least two significant changes through the years with regard to the place of reason: (1) Early in life he abandoned his identification of faith and reason. (2) Only much later did he explicitly acknowledge the correlative fact that reason is very limited so far as the achievement of unquestionable certainty is concerned. He let go of his faith in logic with difficulty, but he finally came to subject the patterns of doctrine and discipline to God's love in all its flexibility and adaptability.

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NEGATIVE STEREOTYPES CONCERNING AMERICANS AMONG AMERICAN-BORN CHILDREN RECEIVING VARIOUS TYPES OF MINORITY-GROUP EDUCATION

(Publication No. 5762)

Joshua Aaron Fishman, Ph.D.
Columbia University, 1953

This study examines the readiness with which American-born Jewish children accept negative stereotypes concerning the majority American group and culture in the midst of which they live. In addition, the content of the negative stereotypes most widely accepted by the children of this minority group is examined. The Jewish children studied were pupils of various types of Jewish schools which differed widely in ideological and structural respects. The central issue investigated by this study was whether the children receiving such widely different indoctrinations for minority group membership would also differ significantly either in their degree of acceptance of negative stereotypes concerning the majority of Americans or in the content pattern of their most frequently accepted negative stereotypes. For the purpose of investigating this issue a Thurstone type instrument ("Young Voters Scale of Needed American Improvements", SNAI) was constructed. The appropriate item weights were determined from rankings by 15 Protestant American and Jewish American judges. The corrected split-half reliability of this scale was + .81.

The major findings of this investigation are:

1. No significant differences were found on the data as a whole between the degrees to which pupils studying in schools under sharply differing ideological auspices accept negative stereotypes concerning the majority of Americans.

2. No significant differences were found on the data as a whole between the degrees to which pupils studying in schools of different structural-types accepted negative stereotypes concerning the majority of Americans.

3. Although the pupils attending Orthodox schools, as such, did not accept negative stereotypes to a significantly greater degree than did pupils attending schools of the other ideological-groups, and, although the pupils attending all-day schools, as such, did not accept negative stereotypes to a significantly greater degree than did pupils attending schools of the other structural-types, nevertheless, the pupils attending schools of the Orthodox-All-Day combination were found to accept negative stereotypes concerning the majority of Americans to a significantly greater extent than the pupils attending schools of all other ideological-structural combinations, when all pupils were grouped according to parental-birthplace categories and according to parental occupational-status categories.

4. Significant differences were found between the degrees to which age groups, in the several ideological-structural combinations, accepted negative stereotypes concerning the majority of Americans, the degree of acceptance decreasing significantly with increased age. Age was the only background variable studied that showed significant differences in degree of acceptance of negative stereotypes concerning the majority of Americans. Pupils differing in length of Jewish school attendance, in parental birthplace, and in parental occupational-status, did not differ significantly in their degree of acceptance of negative stereotypes concerning the majority of Americans.

5. The significant stereotypic differences separating the Orthodox All-Day pupils from the other pupil-groups disappear by ages 12-13. The Orthodox All-Day school itself contributes to a decreased acceptance of negative stereotypes concerning the majority of Americans among its pupils.

6. There are no outstanding differences between the content and pattern of the stereotypes most frequently accepted by the pupils of the various school types. The OAD pupils, however, do demonstrate a somewhat greater acceptance of the more highly weighted or more damagingly negative stereotypic statements than do the pupils of the other school types. However, once more, the older (12-13 year old) OAD pupils demonstrate the same pattern of most frequently accepted negative stereotypes as that revealed by the pupils of all other school types.

7. All of the above has been interpreted as indicating that the different types of minority-group indoctrination do not affect the attitudes of the pupil groups concerning the majority of Americans nearly as much as do the many experiences with the values, practices and institutions of the majority of Americans, which the pupils of the different types of Jewish schools share increasingly as they grow older.

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A THEORY OF INTERPERSONAL DECISION

(Publication No. 5674)

John Walter Gyr, Ph.D.
University of Michigan, 1953

The intentions of this study were threefold.

1. To express a social psychological phenomenon in terms of Lewinian constructs.

2. To express the relationship between the constructs in a rigorous way so that exact derivations could be made from it. In doing so a model provided by Lewin was expanded.

3. To test the theoretical formulation so constructed, and investigate whether Lewin's model was applicable in a situation which was considerably more complex than the individual-choice situations in which the model was first used.

The social psychological phenomenon studied was interpersonal decision. The outcome of a decision could be to work together on the solution of a problem or to be individualistic and solve the problem by oneself. The constructs used to describe this phenomenon were force, valence, and potency of the situation. The basic model describing the relationship between these three constructs was the mathematical formula $f_{P,G} = (VaG)(PoS)$. The symbol $f_{P,G}$ stands for the force on the person, P, to the goal, G. VaG is the valence of G, and PoS is the potency of the situation, S. This basic model was expanded to test the generalizability of the postulated relationship between the three constructs when two separate valences are involved. The expanded model adapted to describe the situation involving two valences, and hence two potencies, is the following: $f_{P,G} = (VaR)(PoS_R) + (VaC)(PoS_C)(PoS_R)$. VaR and VaC stand for the valence of the goal to "be right" and the valence of the goal to "co-operate". PoS_R and PoS_C stand for the potency of the situations which are described by the person in relation to his goals to be "right" and to "co-operate".

The success with which the expanded formulation is able to predict decisions made in an interpersonal context was tested by comparing theoretical predictions of decision and obtained decisions for 134 problem-solving discussions involving 45 individuals grouped in pairs. Each pair participated in two or three discussions. Experimentally created differences of opinion between members of a pair on how to solve problems made it possible for each pair either to arrive at a common solution to the problem or to end their discussion in disagreement. Three experimental conditions were created to vary the amount of disagreement between members of a pair.

It is found that the expanded formulation's accuracy of predicting decisions is considerably better than chance. However, the formulation tends to overestimate the frequency with which discussions end in agreement. The distributions of strengths of force, valence and potency, as well as attitudinal data, suggested two possible ways of reducing errors. (1) The theory should be revised to give higher weights to probabilities when people are sure about a choice than when they are not so sure. (2) The problem is one of measurement. The intervals between scale positions are not unitary, but they proceed logarithmically in some fashion or other. Whether one or both of the above are sources of error could not be determined with the present data.

Thus, the findings indicate that the conceptual relationships inherent in the model provided by Lewin constitute a theory which predicts interpersonal decisions correctly. However, subsequent experimentation may lead to a reformulation of the theory to give greater weight to probability values when people are sure of their choice. In that case, we would have to conclude that Lewin's model needs to be revised in order to be generalizable to situations in which valences leading to opposing forces are present simultaneously.

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CERTAIN PERSONALITY ASPECTS AND PRESSURES TO UNIFORMITY IN SOCIAL GROUPS: AN INVESTIGATION OF SOURCES OF RESISTANCE TO PRESSURES IN UNIFORMITY

(Publication No. 5536)

Godfrey Martin Hochbaum, Ph.D.
University of Minnesota, 1953

The study deals with pressures to uniformity as they exist in small face-to-face groups and arise from the reliance of group members on each other as reference points in establishing social reality for their opinions. It is argued that dependence (the extent to which a person relies on others for validation of his opinions) is a function not only of the properties of the group, such as cohesiveness and distribution of opinions, but also of factors focused primarily in the individual member. One of these factors is his perception of his own competence to judge a given issue and to arrive at a valid opinion. The more competent a person perceives himself to be on an issue, the less dependent will he be on his reference group. The conceptualizations presented by Festinger, Schachter and others in Theory and Experiment in Social Communication are examined in the light of this argument and several hypotheses are formulated, dealing with the relationships between a group member's level of self-confidence concerning a group-relevant issue on the one hand and, on the other hand, such factors as the magnitude of pressure on him to change his opinion, his resistance to such pressures, the power of the group to increase or decrease his level of self-confidence, his need for a "competent" social referent, and the like.

An experiment with small face-to-face groups for testing these hypotheses is described. The experimental groups were assigned tasks involving judgments based on insufficient information. The experimenter induced in some members of each group a high level of self-confidence concerning the tasks, in the others a low level of self-confidence. Some members in each of these two categories were made to perceive themselves as deviates from the group opinion, the others as agreeing with the group against one deviate.

The experimental design yielded data on pressures to uniformity; resistance to such pressures, incidence of changes of opinion and magnitude of such change; amount, direction and content of communication; rejection of the group and acceptance of subgroups as referents; and effects of group processes on the individual member's self-confidence.

Additional data on sex differences and on different locales and of unequal educational backgrounds are examined:

The principal findings can be summarized as follows:

1. The incidence and magnitude of changes of opinion by deviates from a group standard in the direction of greater conformity to that standard are inversely related to their levels of self-confidence concerning the issue on hand.

2. The duration of resistance by a person to prolonged pressures to change is positively related to the level of his self-confidence.

3. The initial level of self-confidence is inversely related to the degree to which a relevant reference group can increase or decrease this self-confidence.

4. Pressures to uniformity tend to manifest themselves in the written communications of "competent" members in the form of pressures on others to change their opinions; in the case of members perceiving themselves as incompetent, in the form of pressures on the writers to change their own opinions.

5. When a multimodal distribution of opinions exists in a group, the degree to which a member accepts that subgroup as a referent which he perceives as the most competent one, is inversely related to that member's perception of his own competence.

6. Differences between the two subsamples are interpreted as showing that some of the "artificial" aspects of the laboratory situation tend to decrease rather than to increase or create the relationships found.

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AN EXPERIMENTAL STUDY OF THE RELATION OF FORMAL ASPECTS OF SPEECH BEHAVIOR TO ROLE-TAKING ACTIVITY

(Publication No. 5842)

Bernard Kaplan, Ph.D.
Clark University, 1953

The present study deals with the dependence of speech behavior on role-taking activity; specifically, it seeks to show how speech behavior changes as a function both of different roles taken and different role takers.

Based on the views of George Mead regarding the interdependence of role-taking and language, this study seeks to illustrate the potential fruitfulness of Mead's viewpoint for psycholinguistic science.

To demonstrate the relation of speech behavior to role-taking, the following experiment was carried out: Two groups —each comprising sixteen male students —were selected on the basis of an avowed preference for either Eisenhower or Stevenson. Each of the thirty two subjects was asked to discuss, from four different points of view, the topic, "Who should be elected to the presidency and why?". The roles taken were the following: student for Stevenson; student for Eisenhower; manual worker for Stevenson; and manual worker for Eisenhower. For purposes of analysis, these roles were also treated in terms of status (student vs worker), in terms of preference (favored vs opposed) and in terms of an interaction of both status and preference (e.g., favored student).

The sequences of roles were controlled; the linguistic role-taking activity of the subjects was tape-recorded.

The protocols were examined in terms of eight indices, reflecting three formal aspects of psycholinguistic functioning. These were as follows:

I. Ease in bringing roles to verbal expression
   a. number of words used
   b. relative incidence of vocalized pauses
II. Linguistic indentification with roles
   a. relative incidence of 'I'
   b. relative incidence of 'we'
III. Linguistic-cognitive organization of roles
   a. average length of macro-units (sentences, non-sentences)
   b. relative incidence of nouns
   c. proportion of descriptive to total adjectives
   d. frequency of rare nouns

Two general hypotheses underlay the study: (1) that different roles taken would be reflected in differential forms of speech activity; (2) that opposing groups would differ in expressing each specific role and would also differ in their patterning of the various roles.

Although no deductively derived hypotheses were made with regard to the specific manifestations of the particular indices in relation to the different roles taken, it was expected that indices of linguistic-cognitive organization would tend to differentiate chiefly between status, while indices of ease in overtly expressing a role would tend to differentiate in terms of preference.

The distributions of the magnitudes of the various indices for the different roles taken and for the two preference groups were statistically analyzed by means of the Wilcoxon T test, an order statistic, making no assumptions as to normality of distribution or homoscedasticity.

The statistical analysis tended to confirm the two general hypotheseses and also supported the pre-experimental expectations. First, all of the roles were differentiated from one another, in at least one of the two preference groups (usually both), in terms of two or more of the indices used. Second, although there were not many significant differences between the two preference groups in taking each of the specific roles, one or more indices did differentiate between the two groups. Differences between the two groups with regard to patterns among the roles were far more striking. Third, the results pointed to a discrimination among the roles qua status roles, in terms of the indices of linguistic-cognitive organization; the indices of ease in bringing a role to expression tended to differentiate in terms

of the preference attribute of the roles.

The present study suggests the potential fruitfulness of the viewpoint which conceives of linguistic behavior as closely related to role-taking activity. It also outlines a number of specific, testable hypotheses with regard to psycholinguistic functioning.

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THE RELATIVE ABILITY OF LEADERS AND NON-LEADERS AS EXPERT JUDGES OF FACTS AND OPINIONS HELD BY MEMBERS OF THE COMMUNITY OF WHICH THEY ARE A PART

(Publication No. 5710)

Lawrence King Northwood, Ph.D.
University of Michigan, 1953.

The current research is a study of leadership, and more especially of one trait which is said to be associated with leadership, the superior ability of the leader to judge facts and opinions of the group he leads.

All the leaders reside in a federal housing project of 12,000 tenants, called a "community" because of its relatively stable existence in a confined geographically contiguous and somewhat socially integrated area. The leaders are, thus, community leaders. Furthermore, by specification, the leaders are either sociometrically chosen by the residents (informal leaders), the occupants of top offices in voluntary organizations or service institutions located in the community (officeholders), or both (formal leaders).

The focal hypothesis of the research is as follows:

The community leader is better able than the non-leader accurately to estimate opinions which are relevant to the community (the population sector which he leads); but he is not superior to the non-leader in making accurate estimates of opinions which are not relevant to that community.

The "True Scores" of community facts and opinions are based on the majority response of a four percent sample of male and female heads of households in the community. All judges, leaders and followers, are asked to make percentage estimates of eight "True Scores" of the community, two of which are considered as relevant to the residents of the Project since they have been widely discussed, and since they are of concern to population being judged.

By comparing the percentage estimate of the judges with the "True Score" of the population it is possible to calculate an "Error Score" for each judge. Those with the smallest Error Scores are considered as expert judges.

From the analysis, it is demonstrated that certain judges excel in a "general ability" to estimate "True Scores" on all kinds of items, relevant and not-relevant to the population being judged. The differences between expert judges and poor judges are statistically significant above the .05 level of significance. However, no type of leader is shown to be significantly superior to follower in the "general ability" to judge all kinds of community scores. Leaders are superior to non-leaders only in judging those items which are considered as relevant. Here, two types of leaders, formal leaders and officeholders, are superior at statistically significant levels to both non-leaders and informal leaders as judges of the relevant scores; they are not superior judges of the not relevant scores.

The findings of the current study are compared with seven other studies concerned with similar problems, and it is concluded that the superior ability of leaders to adjudge scores relevant to groups they lead applies to a variety of populations classified as small homogeneous groups, small heterogeneous groups, large homogeneous social structure, large heterogeneous social structure.

Furthermore, the social organizational characteristics of expert judges were analyzed in an attempt to discover the roots for the expertness. It was concluded that:

1. Expert judges of group norms and population scores more often than poor judges will occupy the key positions (roles, offices) in the communications system of the unit of social organization about which the estimates are made.
2. The more relevant (specific) the fact or the opinion is to the population being estimated, the more likely is the expert judge to be a participating member or leader in that population.
3. Expert judges of community facts and opinions, relevant or not relevant, participate in community organization to a greater extent than do other citizens of the community, but not to a greater extent than the formal leaders and the officeholders of the community.
4. Experts are not so intensely involved in organizations as leaders. They take a lesser role in the management of these organizations through cliques. They are somewhat removed from policy-making, while still being part of the organization.

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THE EFFECT OF GROUP PRESSURES ON OPINION, PERCEPTION, AND COMMUNICATION

(Publication No. 5718)

Bertram Herbert Raven, Ph.D.
University of Michigan, 1953

This is a study of group pressures toward uniformity as they affect opinions, communications, and perceptions of the deviate. It was designed to examine a situation in which pressure toward uniformity manifests itself specifically in pressure on the deviate to change toward the group norm.

Groups of subjects read a delinquency case and privately indicated their opinions of the delinquent on a "favorable-unfavorable" scale. In experimental groups, a false consensus, reported to the subject, indicated that those holding "unfavorable" opinions were deviant from a well-defined group norm. The subjects were given several opportunities to change their opinions. In preparation for a group discussion and unified group report of the case, they wrote individual descriptions of the study. In some groups, the individual descriptions were to be communicated to all other members of the group; in others, the descriptions were to remain completely private. In some groups, there was possibility of being rejected from the group by closed ballot, in others not.

As predicted, deviates were more likely to change their opinions than those subjects at the group norm. Deviates in experimental groups changed toward the norm more than did subjects with comparable opinions in control groups, where no consensus was presented. Deviates were also more likely to change if their descriptions were to be communicated to others in the group, and, less significantly, if they could be rejected for deviance. In addition, it was found that the extreme deviates held their opinions with greater intensity—were less likely to change toward the norm.

The individual descriptions which were to be made public offered a measure of distortion in communicated content relevant to the opinion. In contrast, private descriptions offered a measure of distortion in perceived content. The content items were each rated in terms of whether they supported the deviant opinion or the normative position presumably taken by the group. It was predicted that there would be greater selection and distortion of content toward the norm in communication than in perception—the content at the communicated level would itself be a secondary distortion of content at the cognitive level. It was also predicted that there would be more distortion toward the norm when there was possibility of rejection.

These content-related predictions were not supported by data from deviates, who, from other evidence, seemed to hold their original opinions with great intensity. These deviates attempted to achieve uniformity by influencing others, rather than by changing their own opinions. However, with a separate consideration of subjects who were presumed to be less involved in their initial opinions, every difference was in the predicted direction, though the small number of cases often precluded high significance.

An additional finding showed significantly that changes in opinion effectively decrease the discrepancy between initial opinion and the content of the individual description. On the basis of this and other evidence, a theory of opinion change was suggested: pressure to change may operate first on content communicated and perceived; the opinion would then change to correspond to this distorted perception of content.

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THE EXPERIMENTAL INVESTIGATION OF A VALUE-THEORY OF ATTITUDE STRUCTURE

(Publication No. 5721)

Milton J. Rosenberg, Ph.D.
University of Michigan, 1953

The purpose of this study was to test certain predictions from a theory of attitudes. The theory assumes that when an individual believes that a given "object" (in this study a social issue) facilitates his goals and aspirations or leads to the attainment of these goals (or "values") he will tend to be favorably disposed toward this object. When he believes that the object blocks these goals he will tend toward unfavorable feelings about the object. If he sees the issue as instrumental in producing both good and bad consequences, his attitude toward the issue will be some intermediate resultant of these positive and negative consequences.

In this study an attempt was made to predict degree of favorableness or unfavorableness of attitude from two characteristics of individuals' beliefs about such object-value relationships. These two variables were:

a) Value-intensity - the perceived importance of the attitude-related value as a source of satisfaction for the individual.

b) Object-instrumentality - the individual's judgement about the degree to which the attitude object is a factor in blocking or facilitating the attainment of a given value.

Three major hypotheses were developed from this theory. The first hypothesis assumed that attitudes are more or less favorable depending upon the combined effects of value-intensity and object-instrumentality. For example, an individual who feels that allowing Negroes into white neighborhoods will lead directly to highly valued goals (such as "giving equal opportunities to people") will have a more favorable attitude on this issue than the person who does not regard these goals as important and/or does not believe that they will be attained through the policy in question.

The second and third hypotheses are implied in the first. Hypothesis two assumes that differences in value-intensity will vary with attitude when perceived instrumentality is constant at some level greater than zero. Hypothesis three assumes that differences in instrumentality will vary with attitude when value-intensity is constant at some amount greater than zero.

The testing of these hypotheses involved, first of all, the administration of an attitude scale on free speech for communists. 117 college students took this test and later took a group of "value-tests;" Both measuring devices were of demonstrated high reliability. The value-tests required the subject to judge value items in terms of their perceived intensity and the degree to which they might be attained through the attitude object (free speech for communists). From the value-test data several indices were calculated involving various combinations of value-intensity and object-instrumentality as called for by the three main hypotheses. This combination has been called "induced affect."

The results are consistent with the three main hypotheses. 23 out of 24 comparisons of the attitudes of persons with high and low induced affect yield differences which are shown to be significant when tested by the Chi Square statistic. In other words, the degree of favorableness or unfavorableness of an attitude can be predicted from indices based upon value-intensity and object-instrumentality.

A number of additional findings are also presented. Among these is the discovery that the best predictions of attitudes are made not from the values judged to be most important but rather from those which are moderately important to the person. Another finding indicates that values mentioned spontaneously by the subject are a better basis of prediction than values suggested by the experimenter.

The study closes with a discussion of some of the ways in which change in beliefs about value-intensity and/or object-instrumentality may lead to change in attitude.

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PRIMARY GROUP AFFILIATION AND INSTITUTIONAL GROUP MORALE: A STUDY IN INSTITUTIONAL GROUP DYNAMICS

(Publication No. 5823)

Henry Zentner, Ph.D.
Stanford University, 1953

The objective of this study was to determine the extent to which Shils' conception of the primary determinants of institutional group morale obtaining in the case of a military setting is valid for the explanation of institutional group morale in an educational setting. The independent variables postulated by Shils are: (1) attachment to, or identification with, the goals and objectives of the institutional group; and (2) quality and extent of membership in primary groups.

Logical manipulation of the hypotheses set forth by Shils yielded a total of six hypotheses which were tested by observing the behavior of selected categories of incoming freshman students.

The sample employed consisted of two sub-groups, each consisting of forty-six male Stanford freshmen. The two sub-groups were selected so as to have maximum differences between them in extent of initial informal primary group affiliation. Their behavior was observed from the beginning of their membership in the institutional group throughout the first two quarters of residence on campus.

Five dimensions of behavior were selected for observation. These were: (1) reference group morale; (2) institutional group morale; (3) institutional primary group relations; (4) informal primary group relations; and (5) personal esprit. Data relating to these variables were collected by a questionnaire, administered on a test-retest basis at intervals of not less than six weeks during the first two quarters of residence on campus.

The responses to the items defining each of the five dimensions were reduced to attitudinal scales by scalogram analysis. A patterning of items consistent with the hypothesis of unidimensionality was evident for each of three occasions of measurement in the case of the following three dimensions: (1) reference group morale; (2) institutional group morale; and (3) informal primary group relations. The corresponding scales were therefore regarded as both reliable and internally valid. However, in the case of the institutionalized primary group relations and personal esprit dimensions, scalogram patterns consisting of less than the minimum number consistent with the hypothesis of unidimensionality were disclosed. Although the internal validity and reliability of these patterns were doubtful, they were employed analytically with appropriate qualifications.

Primary analysis of the data failed to reveal a reliable association between measures of institutional group morale and measures of the dimensions of behavior representing the several independent variables. The absence of such association left unsubstantiated four of the six hypotheses of the present investigation. Since association between institutional group morale and the independent variable, personal esprit, could not be reliable determined, it was concluded that the implications of the data for the two remaining hypotheses were indecisive.

Secondary analysis of the data was undertaken but no patterned associations having implications for the hypotheses being tested were found. Although a few fugitive relationships of apparent significance did emerge upon secondary analysis, the absence of supporting evidence rendered conclusions hazardous.

A comparative theoretical analysis of the military and educational institutional setting was undertaken, the results of which gave added plausibility to the negative findings of the study.

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SOCIOLOGY, GENERAL

PATTERNS OF INTERNAL MIGRATION, NORRISTOWN, PENNSYLVANIA, 1910-1950

(Publication No. 5593)

Sidney Goldstein, Ph.D.
University of Pennsylvania, 1953

Supervisor: Dorothy S. Thomas

This dissertation has been orientated towards two goals: (1) to devise a methodology which would permit the determination of the volume and character of in- and out-migration in Norristown, Pennsylvania during the last half century; (2) to use this methodology for analysis of the role of migration in changing the socio-demographic structure of the Norristown community in this forty to fifty-year time span.

In the first section of the study, the data collected by a survey of ten percent of Norristown's households were analyzed to determine their value for an historically orientated study. The major limitations of the survey as a source of historical migration data were shown to be inherent in the fact that a household survey is limited to the population currently resident in the community. No data are therefore obtainable about most of the persons who out-migrated, and data on in-migrants are obtainable only for those who moved to Norristown and are still living there at the time of the survey. Since neither the in-migrants nor the "old-timers" currently resident in Norristown can be regarded as representative of both these earlier cohorts, no exact data are available from this source on either the total volume or the selective character of migration to the community during the entire period under investigation. The survey does, however, yield valuable data on the volume and demographic characteristics of the survivors of the total in-migrant group, and by a comparison of the size and characteristics of this group with that of the surviving non-migrant group the net effect of this total in-movement on the Norristown community was determined.

In order to obtain more complete measures of the total volume and character of both movement into and out of Norristown in each of the decades from 1910 to 1950, other sources of data with sufficient historical depth were sought. These were available in the form of vital statistics records, school records and city directories. By selecting five percent samples from the city directories of each decennial year from 1910 to 1950 and tracing each of these samples through both the five succeeding and five preceding directories of each decade, it became possible to identify those persons who were resident in Norristown throughout each ten year period and those who were resident there only part of the decade. Of the latter group some disappeared in the forward tracing process because of death and others because of out-migration. Among those who did not appear in the earlier directories, some were not listed because they were too young and others because they were not living in Norristown in the earlier years of the decade. By the use of the vital statistics and school records, it became possible to identify those who disappeared because of death and those who were not listed because they were too young. It thus became possible by the method of residues to identify the out-migrants and in-migrants in Norristown in each of the four decades. Since the directory contained information on the occupation of each person listed, this form of an analysis permitted the determination of both the volume of migration and its selective character as well as the patterns of occupational mobility.

This analysis showed that from 1910 to 1950 migration accounted for 73 percent of the population growth of the adult male population of Norristown. The importance of migration in population growth varied greatly, however, in each of the four decades, declining steadily from a net rate of migration in 1910 to 1920 of 124 per 1,000 population to 8 per 1,000 population in the 1940 to 1950 decade. Despite the reduced net gain from migration, the volume of in-and-out-movement continued to be high throughout the forty years with a minimum in- and out-movement during each decade of at least 300 persons per 1,000 resident there at the beginning and the end of the decade. The selective character of migration has also changed greatly. The beginning of the forty-year period was characterized by high rates of gain for all occupational groups except service workers. By 1940 to 1950, the majority of occupational groups showed net migratory losses, and only the managerial groups and the semi-skilled laborers continued to experience net gains through migration. Thus where-as migration was the most important single factor in the growth of the different occupational groups in the 1910 to 1920 decade, by 1940 to 1950 its importance was greatly reduced and occupational mobility on the part of the resident population of Norristown became more important in sustaining or increasing the size of all groups but the clerical and semi-skilled laborers.

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A STUDY OF WORK SATISFACTIONS AS A FUNCTION OF THE DISCREPANCY BETWEEN INFERRED ASPIRATIONS AND ACHIEVEMENT

(Publication No. 5701)

Floyd Christopher Mann, Ph.D.
University of Michigan, 1953

The primary objective of this study is to investigate the extent to which work satisfactions of non-supervisory employees are a function of the discrepancy between aspirations and achievements. The major hypothesis is that satisfactions of non-supervisory employees with certain aspects of their occupational status are inversely related to the level of education they have attained, when type of work, job skill level, length of service, and sex are held constant. This hypothesis rests upon two assumptions. Education and the factors associated with it create high aspiration levels or separate those who have high motivation from those who have low motivation to achieve. A sociological variable like education can be used as an index of aspiration.

The major hypothesis is tested through relating satisfaction with job responsibility and satisfaction with promotional opportunities to the educational attainment of 8000 non-supervisory employees working at a wide range of jobs in a large electric light and power company in early 1948. The extent to which the findings from this hypothesis can be generalized is explored through the use of different research populations and different types of questions. It had also been hypothesized that the magnitude of the inverse relationship between attitudes and education would not be as great for women as for men, for white collar as for blue collar employees, for questions having low relevance to occupational achievement as for questions having high relevance to occupational achievement. Four additional measures were used to test the generalization gradient of the hypothesis: (1) perception of utilization of skills, (2) perception of adequacy of job placement, (3) overall satisfaction with company and job, and (4) evaluation of supervisor's ability to handle people. Predictions were also made concerning the relationship between attitudes toward the work and length of service, skill level, and age.

In general the findings were consistent with the major hypothesis and its elaborations. Education was found to be inversely related to:

a. Satisfaction with job responsibility for blue collar men, white collar women.

b. Satisfaction with promotional opportunities for blue collar men and white collar men.

c. Perception of utilization of skills for blue collar men.

d. Perception of adequacy of job placement for blue collar men.

e. Overall satisfaction with company and job for blue collar men.

f. Evaluation of supervisor's ability to handle people for blue collar men.

Length of service was found to be curvilinearly related to satisfaction with job responsibility and promotional opportunities for blue collar men; a similar relationship was found for satisfaction with promotional opportunities for white collar men. Job skill level was found to be directly related to satisfaction with job responsibility, promotional opportunities, adequacy of use of skills, and overall satisfaction with company and job for white collar men. Perception of utilization of skills and job skill level were also directly related for blue collar men and white collar women. Overall satisfaction with company and job was directly related to age for blue collar men.

The confirmation of the major hypothesis suggests that there is some problem of institutional coordination in American society today. Educational and related institutions create levels of aspiration and expectations about occupational opportunities which present economic institutions do not meet.

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SYSTEMATIC SOCIOLOGICAL THEORY IN THE UNITED STATES: AN EXPOSITION, ANALYSIS, AND SYNTHESIS OF THE METHODOLOGICAL AND SUBSTANTIVE THEORIES OF GEORGE H. MEAD, TALCOTT PARSONS, AND GEORGE A. LUNDBERG

(Publication No. 5927)

John Clifford McKinney, Ph.D.
Michigan State College, 1953

The primary object of this study has been to point out important areas of convergence in selected diverse sociological systems. Convergence has been operationally defined as "similarity of statement or treatment". This has been an attempt to demonstrate the thesis that the adaptation of the scientific point of view to social behavior, even though manifest in different frames of reference, leads to certain similarities of treatment. It has been hypothesized here that there are basic and important similarities underlying diverse treatments of social phenomena.

Mead, Parsons, and Lundberg were chosen as being representative of different and important theoretical positions. It is generally conceded that their approaches to sociological phenomena are quite "different" and that they are representative of different intellectual continuities.

Examination of the validity of the central hypothesis and its subordinate propositions was made in terms of a three-element procedure. First, an exposition was made of the theoretical positions of Mead, Parsons, and Lundberg from <u>their</u> points of view, and in terms of <u>their</u> problems. An attempt was made to lay out the major components of their

systems as they had developed them. This means that the three expositions were made independent of one another, and independent of the major hypothesis.

Second, running concurrently with the expositions of the major components of their systems, is an analysis from our point of view involving three criteria. Commentary was made on the systems of Mead, Parsons, and Lundberg in terms of: (1) implications for the field of sociology, (2) internal inconsistency in their exposition, and (3) the holding of an "extremist" position relative to one more generally held in the field of sociology.

Third, similarities of statement or treatment were selected out of the three independent expositions and labeled as categories of convergence. These categories were inductively arrived at; they were not developed prior to the examination of the three independent expositions. Wherever the three theorists appeared to be making similar general statements about similar general phenomena, those statements constituted an area of convergence, and thus could be labeled as a category. Convergence was discovered by working on the three levels of: (1) what they say, (2) what they do, and (3) what they mean. This resulted in two kinds of convergence: (1) explicit, and (2) implicit.

This procedure resulted in the extraction of twelve general areas of convergence from the diverse systems of Mead, Parsons, and Lundberg. These theorists manifest considerable methodological similarity in the general categories of: Science and Research; the Object World; Uniformities and Causal Imputation; and Process: Structure and Function. In the substantive field substantial convergence was found in the general categories of: Interaction; Values, Motives, and Action; The Social System; The Regularities in Social Behavior; Symbolic Systems; and Social Change.

The extraction of these categories of convergence give evidence that seems to be substantial enough to warrant at least a tentative holding of the hypothesis that the treatment of social phenomena from the institutionalized general position of science leads to important convergence of theory, even though different frames of reference are used.

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EMPLOYMENT AND SOCIAL STRUCTURE: A STUDY OF SOCIAL CHANGE IN INDIANA

(Publication No. 5874)

Louis H. Orzack, Ph.D.
Indiana University, 1953

The inadequacy of the conceptual dichotomy of rural and urban is studied by examining the historical development and structural unity of aspects of a community (Monroe County, Indiana) involved in the general transition from rural-agricultural to urban-industrial types of social structure. The ways in which details of agricultural and industrial changes have affected certain aspects of the community's structure and of the outlook of members of the community constitute the focus of the study.

Agricultural self-sufficiency so marked particularly during the early 1800's has lost importance among rural people, as erosion of the hilly terrain, general deforestation and market competition of produce from flatter, better nourished soils elsewhere have transferred local farmers to marginality. Although such farmers may maintain identifications with rural segments of the population, their agricultural activity has become minor, and the joint incidence of part-time farming and industrial employment is quite high. The familiar concepts of rural and urban are therefore appraised in terms of the underlying assumption of the identity of residence and employment. A consequence of the industrial employment of marginal farmers is suggested to be their lack of interest in soil conservation and anti-erosion measures.

From an industrial point of view, Bloomington was the site of the expansion of a wood-working shop of the 1860's to be the world's largest furniture-producing factory in the 1920's. Skilled wood craftsmen were succeeded by assembly-line workers; gesellschaft ties of employer and employee intensified; and a formal welfare program was established. The depression and the loss of strategic competitive advantages led to a reduction of the number of employees, the ending of the welfare program, the aging of retained workers as recruitment of new permanent employees has diminished, and a general loss of stature of the company in the community. A radio plant, established locally in 1940, and expanding since then, has continued generally to increase in size, but has limited employment mainly to youth.

The labor market is marked therefore by concurrent industrial decline and industrial rise, involving alterations of the attitudes expressed by community residents and factory workers toward the factories and toward work-linked aspects of their own roles. Young men in the 20's and 30's were interviewed so as to shed light on the relationships between aging and occupatuonal perspectives. Theoretical and methodological complications of inferences as to aging correlates are discussed. The comparison of the two groups of employees roughly ten years apart in age suggests that as men age from the 20's to the 30's in a factory where the tradition of opportunity is over-riding, their beliefs in the possibility of advancement comes to include recognition of boundaries to advancement set by the structural conditions and organization of the plant. The personality basis for advancement loses relative importance in their thinking. At the same time, these men moving into and through the thirites come to visualize the factory in terms of its welfare programs and the support to their own security that they can thus derive.

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THE IMPACT OF TRANSPORTATION CHANGE AND OF FLINT METROPOLITAN EXPANSION ON THE LINDEN COMMUNITY: A CASE STUDY OF ECONOMIC CHANGE FROM 1900 TO 1950

(Publication No. 5715)

Samuel Alexander Pratt, Ph.D.
University of Michigan, 1953

This study is a case analysis of the changes from 1900 to 1950 in the business functions of a small community and the relationship of these changes to transportation alteration and to the absorption of the small community into an expanding metropolitan community. The conclusions are based on cross-section reconstructions of Linden, Michigan, in 1900 and 1950 and analysis of the conversion from rail to motor vehicle transportation and the increased inter-action of Linden with Flint city. Linden was a community of 2,200 in 1900 and 4,450 in 1950.

Under the conditions of rail and horse transportation in 1900, Linden was relatively self-sufficient locally and dependent in a regional and national economy. The village was solely a farm center meeting all the basic needs of a farm business and farm population markets. General farming was the economic function of the village trade area. The community was organized around the balanced interdependence of the village and farm sub-systems. In the ensuing 50 years the automobile and truck were substituted for the railroad as the principal means of transportation. The resulting reduction in time-cost distance in the local area led to absorption of Linden into the growing Flint metropolitan community. Flint provided a few infrequent services for Linden in 1900 but in 1950 nearly half of Linden's labor force worked in Flint and the city provided many economic and social services for the small community. As a sub-community in 1950, Linden had a specialized economic structure. The village specialized in frequently needed, inexpensive consumer commodities and services while the farm system was concentrating in dairying and livestock. The non-agricultural labor force replaced the farm system as the principal income source of the community, and the locally balanced interdependence of farm and non-farm systems was disrupted.

The major conclusions were: 1) the independent community of 1900 was converted to a sub-community; 2) the general trend was toward sub-community specialization, though Linden did not become a one-function town; 3) functional expansion was concentrated in the non-agricultural functions, village businesses increasing nearly 100 percent while the number of farms remained about the same; 4) increased specialization in the village was marked by growth in retailing, home construction, real estate, insurance, and recreation functions and a relative decrease in manufacturing, personal and professional services, repair services, and communications, and an actual decrease in marketing, financing and specialized transportation; 5) village change occured through discontinuance of half of the 1900 units, modification of the business units continuing from 1900, and the addition of new units and functions; 6) non-agricultural functions, particularly recreation and construction, developed in the service area; 7) the general farming system was converted to a specialized system in which milk was the largest income producer; 8) farm marketing was oriented to a metropolitan market in 1950 as compared with a national market in 1900; 9) generally, the transformation was from a locally independent community to a metropolitan sub-community, in the latter form serving as a residential, recreation, and a perishable food production and processing area for the metropolitan community. The economic changes had general impact on the bases of integration in the community, the economic system declining as a small community integrative force.

Metropolitan expansion was the major source of change but national economic change was also important. The metropolitan influence was felt through suburbanization, decreased individual dependence on the local community, development of a transient market, farm producer mobility, and the rise of new competitive factors within the expanded community.

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MIGRATION IN THE PHILADELPHIA SUBREGION, 1935-40

(Publication No. 5610)

Sherman L. Ricards, Jr., Ph.D.
University of Pennsylvania, 1953

Supervisor: E. O. Hutchinson

Introduction

This study of subregional migration has been focused on a large metropolitan area in which there has always been a well-developed ring characterized by the presence, throughout time, of ever retreating landed estates and an expanding transport system. The time interval of the analysis was one which should provide an excellent benchmark for further research, for from the point of view of economic conditions, it was of neither the low of the depression 30's nor the high of the wartime 40's.

Data stemming from previous research, an analysis of out- and in- migration to cities of 500,000 population or more, and Bogue's work in respect to the migration to and from Boston have been presented in order to provide pilot hypotheses for the investigation. Many conclusions have developed, most of which have been listed, and the purpose of this chapter is to point out those which appear to be of major importance, in respect to the basic hypotheses, and briefly to state a few sociological implications in respect to subregional migration, which may be drawn if these patterns were to continue.

Basic Conclusions

About 41 per cent of the migrants who left the two cities remained in the subregion, while about 25 per cent of all the migrants who entered the two cities were originally from the subregion. Further, the migrants who left the two cities for the subregion tended to go to places on the particular side of the river in which that city was located. In other words, Philadelphia generally sent to and received from the ring area in Pennsylvania, while Camden generally sent to and received from the ring area in New Jersey. Also, the migrants who left the two cities went to other urban places within the subregion more often than they went to either of the other two destination. In spite of this conclusion, the data implied that a larger portion of the migrants who entered the two large cities came from places of less than 10,000 population than came from places over that figure. Further, migrants both entered and left Camden at greater rates than they did Philadelphia.

The data in reference to the cities of 500,000 population or more indicated that 1.5 times as many persons left these cities as entered them during the 1935-40 period. The data in regard to Philadelphia and Camden indicated that 1.9 times as many left the two cities as entered them, while 2.6 times as many left the two cities for the ring areas as left the ring areas for the two cities during the same period.[1] Thus the drive to leave the city must have been greater for these two cities than for the cities of the country in general.

The streams which left the two cities manifested a selective pattern which was similar to that of the streams which left the cities of 500,000 population or more: i.e., males were selected to a greater extent than were the females. However, the stream which entered Philadelphia did not manifest the national selective pattern, while the one which entered Camden followed the national pattern: i.e., females were more often selected than were the males. However, subregional migration streams have shown little or no selective pattern according to sex. However, it must be stated that the migrants who left the cities for the subregion did manifest a higher sex ratio than did those who entered the cities from the subregion. Such a pattern might cause the below normal sex ratios to remain the same or even go lower.

Although proportionately more nonwhites than whites migrated to the cities of 500,000 population or more, the data in reference to total migration to Philadelphia and Camden indicated just the opposite: i.e., whites were more migratory than nonwhites. The pattern of differential migration for out-migration (whites more migratory than nonwhites) from Camden and Philadelphia was in general agreement with the basic hypothesis.[2] The data in reference to subregional migration, generally not comparable to Bogue's data, indicated that whites were more migratory than were nonwhites irrespective to the direction of the particular stream.

Although the males who entered Philadelphia and Camden and those who entered cities of 500,000 population or more were about the same median age, the females who entered the former were generally about two years older than those who entered the latter. Both the males and females who left the two large cities were appreciably younger than those who left the cities of 500,000 population or more. The migrants who participated in the subregional streams manifested generally about the same or somewhat lower median ages than the migrants who took part in the migrations within the Boston subregion.[3] All streams, when expressed graphically, manifested the basic w-curve.

The data contained herein were in general agreement with Bogue's data that about two-thirds of all migrants were married, and that among subregional migration streams there were proportionately more unmarried persons in the incoming than outgoing streams.

The migrants who entered Camden and Philadelphia from the entire nation were to a lesser extent family-connected (69 per cent) than were those who entered the cities of 500,000 population or more (73 per cent). Both the total migrants who left Philadelphia and Camden and those who left the cities of 500,000 population or more were family-connected in about 80 per cent of the cases. Subregional migration streams all contained more family-connected persons, by volume, than those of the opposite type (at least 85 per cent). The pattern of out-migration was clearly one of husband and wife, while that of in-migration was not as strongly in this direction.

The total migrants who left the two cities attained a higher median grade than did those who entered the cities, while the basic hypothesis, in regard to cities of 500,000 population or more, was that no differential existed. Nevertheless, the total migration data and those of the cities of 500,000 population or more were in general agreement that the rate of migration increased with the rise in education. The subregional data treated in this investigation and Bogue's were in general agreement that: (a) persons of low educational attainment were not particularly migratory; (b) persons of high educational attainment migrated more than did those of low educational attainment; and (c) the incoming streams were more selective for highly educated females than were the outgoing streams. The streams which left and entered the two cities in the Philadelphia subregion appear to have selected highly educated persons more than did the streams which either left or entered Boston.

By far the major finding of this investigation with respect to labor force status was the pattern of working-male and non-working female in the outgoing stream and that of the working-male and female in the incoming stream, which was in basic agreement with the pattern manifested by the migrants who entered and left the cities of 500,000 population or more. The streams which entered and left the two large cities for the subregion manifested this same selective pattern as did the streams which Bogue analyzed.

The streams of migration which entered the two large cities were both more selective for high occupational status personnel of both sexes than were the

streams which entered the cities of 500,000 population or more, while those streams which left these two cities were as selective as the streams which left the cities of 500,000 population or more for these high occupational status personnel. In substantial agreement with Bogue's conclusions, the subregional migration data indicated that the streams which left the two cities were more selective for high status personnel than were those streams which entered, the streams which entered were highly selective for high status females, and high status personnel took part in all streams to a greater extent than did low status personnel.

Both the data contained in this investigation and Bogue's conclusions were in agreement that high income persons were more migratory than were those of low income. This basic conclusion held true in both outgoing and incoming streams. A minor deviation was the fact that the incoming streams were somewhat selective for high income females.

Thus it can be stated that although minor differences could be and have been stated relative to basic hypotheses, total and subregional streams, in the main, certain main conclusions stand out: all sources of data indicated that the typical migrant who entered the city was young, either male or female, married, of high educational attainment, of moderate to high income;while the typical out-migrant was slightly older, either male or female, a higher proportion of married, of higher proportion of married, of higher educational attainment, and of higher income than the in-migrant.

1. No such comparison could be made of Bogue's data although he has stated that Boston's total net loss to the ring was about 25,000 (p. 4). Philadelphia's total net loss was about 28,000.
2. See Ch. I. p.
3. Ibid.

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A STUDY OF STRATIFICATION IN THE UNITED STATES

(Publication No. 5741)

Ralph Spielman, Ph.D.
University of Michigan, 1953

This study is an investigation of the degree of consistency among indicators of soci-economic status and of certain correlates of this degree of consistency in an area sample of the urban population of the continental United States in 1949 - 1950. Each of the 2,292 spending units of the sample — defined as groups of persons living in the same dwelling and related by blood, marriage, or adoption, who pool their incomes for their major items of expense— was assigned one of three rank positions (high, intermediate, and low) in each of three rank systems pertaining to education, income, and occupation. The spending units of the sample were thus sorted in twenty-seven status profile groups. Spending units with equivalent rank positions in the three rank systems were regarded as having consistent social status profiles, while those holding different rank positions in the three rank systems were regarded as having inconsistent social status profiles. Differential degrees of status inconsistency were discerned.

A pronounced tendency toward status consistency was found to exist in the sample. The proportion of spending units with consistent status profiles was found to be more than 300 per cent of the figure expected if spending units were randomly distributed over the twenty-seven status profiles, i.e., if positions in the three rank systems were independent of one another. Two-thirds of the spending units were found to show some degree of status inconsistency. Thus, partially crystallized status strata were discerned.

The spending units were further sorted in a hierarchy of three status levels, each containing a group of consistent and a group of inconsistent status profiles. The hypothesis that to different positions in the status hierarchy correspond different levels of participation in the life of the society was tested by correlating a number of behavioral variables with the status hierarchy. Among these are liquid assets held, net worth, face value of life insurance policies, life insurance premiums as per cent of income, and year model of automobile. Interviewees' attitudinal responses to two questions pertaining to the well-being of the country and to the respondents' feelings regarding their own financial security also were found to correlate with the hierarchy of social status. The influence of education, occupation, and income separately on this variation and the influence that these three factors have in their combinations were investigated and tested by the method of analysis of variance. It was shown that status, conceived as a combination of rank positions in education, income, and occupation, can be used to improve explanations of behavior variations obtained by correlating them with the three factors separately.

It was demonstrated that behavioral variations indicating different levels of participation in the benefits derived by individuals from the social organization of their efforts in this society correspond to different positions in the partially crystallized status structure. The imperfect crystallization of the status groups appears to be connected with structural changes that this society is undergoing at the present time. On the basis of the evidence produced by this study, future increases in the degree of this crystallization do not appear improbable.

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SOCIOLOGY, FAMILY

ATTITUDES OF HIGH SCHOOL SENIORS IN A NUMBER OF SELECTED COMMUNITIES TOWARD MARRIAGE, SEX AND PARENTHOOD AS CORRELATED WITH STANDARD OF LIVING AND SUBSEQUENT ENROLLMENT OR NON-ENROLLMENT IN COLLEGE

(Publication No. 5491)

George Rufus Ragland, Jr., Ph.D.
State University of Iowa, 1953

This study was designed to do two things. The first aim was to determine what attitudes a selected group of high school seniors held toward the moral norms regulating premarital sexual intercourse, extramarital behavior, unmarried cohabitation, and divorce; and to indicate to what extent these attitudes were related to attendance and non-attendance in college, sex, rural-urban background, and leadership in extra-curricular activities. The second aim of the study was to gain knowledge regarding the hypothesized relation between the aspiration-levels of these high school seniors and their socio-economic status; and to find to what extent their standards of living were related to their attitudes toward education, working-wives, and parenthood, as well as toward the moral norms regulating the behavior described above.

Specifically we sought to test the following hypotheses:

1. Those graduating high school seniors who will enter college upon graduation support to a greater degree the moral norms regulating sex, marriage and divorce than do those who are not to attend college.
2. That group holding official positions in extra-curricular activities will contain a higher proportion of persons with attitudes in support of the moral norms than will be found among that group composed of non-office holders.
3. Those who will attend college have higher standards of living than do those who are not to attend college.
4. Those persons having the higher standards of living will conform to the moral norms to a greater degree than will those having the lower standards.

The subjects of our study were 155 of the 159 second-semester seniors of the eight separate high schools in Smith County, Texas; four of the students were not available when the study was made. The problem required that the data be collected from two sources: the high school students and the principals of the high schools.

The method of collecting our data from the students was by the use of a questionnaire, when a visit was made to each of the eight high schools and a questionnaire was given to each of the seniors who were assembled in a group. The questionnaire was constructed so as to secure four general types of information: 1) biographical data. 2) socio-economic level of the parents, 3) attitudes toward the moral norms, and 4) aspirations of the students.

In the fall of the same calendar year the high school principals provided data stating which students enrolled in college upon graduation from high school.

Standard of living was defined in our study as the level of living which persons strive to realize. Occupational expectations and income expectations were used as indices of the subject's standard of living.

Chi square (X^2) was used to test the existence and degree of association between the several variables. In our use of chi square, the 5 per cent level of probability was adopted as the criterion of significance.

One of our hypotheses was validated in this study: Those who will attend college have higher standards of living than do those who will not attend college.

Another of the hypotheses are only partially validated: Those graduating high school seniors who will enter college upon graduation conform to a greater degree to the moral norms regulating sex and marriage; but those who are not to attend college support to a greater degree the norms regulating divorce.

Two of the hypotheses were not validated by the data: 1) That the group holding official positions in extra-curricular activities will contain a higher proportion of persons with attitudes in support of the moral norms than will be found among that group consisting of non-office holders; and 2) those persons having the higher standards of living will conform to the moral norms to a greater degree than will those having the lower standards.

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SOCIOLOGY, SOCIALISM, COMMUNISM, ANARCHISM

HISTORY OF THE COMMUNIST PARTY OF GREAT BRITAIN, 1939-1946

(Publication No. 5792)

Augustine Patrick Donoghue, Ph.D.
Stanford University, 1953

This dissertation first examines the equalitarian teachings and practices of John Ball, John Wyclyf, and other social critics, as well as the various protest movements in Britain which, between the fourteenth and twentieth centuries, sought a greater dispersion of economic and political power among the citizenry. The Communist claims that Britain possesses a revolutionary tradition and that the British Communist party is its sole legatee are evaluated.

The immediate origins of the British Communist

party are then traced, through the Bolshevik Revolution of 1917, to the formulation by Marx of an explicit political mission for the working class which was to be fulfilled under the leadership of a revolutionary elite. The dialectic process by which an enslaved proletariat was ultimately to gain the supreme power of the state was based on the irreconcilability of interests between capital and labor and the unrelenting prosecution of a class war. Marx assumed the inevitability of violence in effecting the transfer of state power from a capitalist to a proletarian government. These concepts, as modified by Lenin and by the national interests of the Soviet Union, are shown by a historical survey to be the decisive influences which have determined the program and practices of the British Communist party.

The party's establishment in 1921 as a section of the Third International, under the control of the Russian Communist party whose Presidium (formerly Politburo) governs the U.S.S.R., deprived it wholly of freedom of action. It was committed exclusively to enact the role of propagandist and promoter in Britain for Soviet Russian interests and for whatever policies, at a given moment, the Comintern believed would safeguard those interests.

This paper records the manifold consequences of the British Communist party's subservience to the Soviet government. Internally, subjection to the will of the Comintern determined the authoritarian structure and non-democratic practices of the party organization. Externally, it led to sudden and discrediting reversals of policy toward the British Labour party, the League of Nations, the Hitler regime, and toward German and Soviet acts of aggression, to instance but a few examples. It resulted, in 1939, in the party vehemently opposing Britain's war against Germany, and supporting that war two years later the moment Germany's attack thrust Soviet Russia into the conflict. The party's dramatic somersaults on these and other critical issues are described and analysed in terms of the shifting objectives of Soviet foreign policy.

A detailed description is provided of the party's elaborate propaganda apparatus for exploiting the mediums of print, film, public forums, and Parliament; for infiltrating social and professional organizations, and for organizing study groups and special schools in its ceaseless quest for converts and sympathizers. The conspicuous role played by the latter in the Soviets' espionage network, during and after the War of 1939, is dealt with at length. Yet despite its intense and unrelenting efforts, the party remained politically ineffectual.

An examination of the reasons for the party's failure to win the support of British workers, even in a period of marked social discontent, reveals how the Labour party, both by steadfastly blocking the Communist party's admittance to the labor movement and by achieving major social reforms through Parliament, denied the Communists direct access to the working classes and eliminated the causes of disillusionment and despair upon which Communism thrives

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ABSTRACT AND CONCRETE BEHAVIOR OF DYSPHASIC PATIENTS AND NORMAL SUBJECTS ON THE GOLDSTEIN-SCHEERER TESTS

(Publication No. 5644)

Irwin Brown, Ph.D.
University of Michigan, 1953

This study compares the performances of a group of patients with dysphasia and a group of normal individuals on the Goldstein-Scheerer Tests of Abstract Behavior. These tests are based on the theory of Dr. Kurt Goldstein that all behavior can be classified as abstract or concrete and that the two groups can be predictably differentiated on the basis of their test performances.

Goldstein's contributions have been widely accepted, whereas his experimental data, where provided, have not been statistically validated.

Subjects of this study consisted of fifteen in the experimental group, drawn from the dysphasia therapy program at the University of Michigan Speech Clinic, matched with a like number of normal subjects, on the bases of sex, age, occupation, and education. The five tests of the Goldstein-Scheerer battery were divided into parts for which success or failure could be recorded. Insofar as possible the tests were administered exactly as Goldstein recommends. Data were compiled in terms of the total number of successes achieved by each subject on each test. These data were treated by several statistical techniques.

The following null hypothesis is tested:

There is not a significant difference in ability to behave in abstract fashion, as defined by Goldstein and as measured by the Goldstein-Scheerer tests, between a group of normal individuals and a group of dysphasic patients.

The general results of the study are:

1. An overall comparison of performance shows that no significant difference in abstracting ability exists at the 5% level of confidence between the two groups.

2. A difference between the two groups, however, closely approached the 5% level for the results of the Stick Test, in favor of the normals.

3. Closer examination of performance on the tests yielded data and observations which further clarify the nature of the abstract behavior of the two groups. These data aid in making the tests more valuable clinical tools.

a. Only one phase of the Stick Test need be retained. The copying phase was chosen as being more economical in time.

b. On the Color Form Sorting Test, a significant difference between the two groups in favor of the normals was found in the matter of requiring assistance (Experiment 3). It was recommended that this phase be made the crucial part of this test.

c. The Cube Test, Object Sorting Test, and Color Sorting Test failed to show differences between the groups and it was recommended that they therefore be excluded from the series. It was further recommended, however, that further research be conducted with these tests with clearer instructions to the subjects.

4. Due to the small sample in this experiment, the null hypothesis established originally can be supported, but not accepted. Goldstein's hypotheses may be considered to be supported for the Stick Test, but not for the other tests.

5. No relationship was established between achievement on the tests and age, occupation, and education.

6. There is no clear-cut evidence of a relationship between test achievement of the experimental group and time since injury.

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AN HISTORICAL STUDY OF THOMAS WOOD STEVENS' GLOBE THEATRE COMPANY, 1934-1937

(Publication No. 5467)

Donna Rose Feldman, Ph.D.
State University of Iowa, 1953

The purpose of this study is to present a history of Thomas Wood Stevens' Globe Theatre Company. Stevens, a director and educational theatre leader, and Marc T. Nielsen, an interior decorator, organized Globe Theatre Productions, Limited, a corporation in which the actors were share-holders, in April of 1934 for the purpose of presenting the plays of Shakespeare before exposition audiences at A Century of Progress in Chicago, Illinois. The company existed until 1937, during which time it presented over five thousand performances of nineteen plays, eighteen of which were by William Shakespeare, to audiences of over two million people.

The principle of production to which the Globe Theatre Company adhered was based on Thomas Wood Stevens' theory that "all arts live by their conventions." To present the plays of Shakespeare in accord with this theory, the company turned to the conventions of the Elizabethan theatre and performed its productions in a replica of the Globe Theatre in Shakespeare's London, with continuous action and without scenery.

The company numbered twenty-seven actors, who worked on a repertory system, playing leading roles in one play, and minor roles in others. To maintain an Elizabethan atmosphere, activity on the Village Green outside the theatre consisted of English country, sword and morris dancing. The dancing served to gather crowds in front of the theatre before performances, also. Seven performances were given a day, with as many as nine given on week-ends and holidays. To meet the exigencies of exposition activity, the plays were cut to running times of from thirty-five to fifty minutes. Later in the life of the company, longer versions were presented, which lasted from seventy-five minutes to two hours.

During its three year existence the Globe Theatre Company presented its repertoire at four expositions and at theatres and auditoriums throughout the Middle West and West. In 1934, after its organization, the company played through the Summer at A Century of Progress until October 31, when it embarked on engagements at two Chicago theatres and tours of the Middle West. During its second season the company played at the California Pacific International Exposition in San Diego, from June until November of 1935, when it went on a tour of the West Coast under the auspices of the Redpath Bureau. In February, 1936 the company returned to San Diego for the second season of the exposition. This year saw an expansion of the company's activities, with three units in existence. The Blackfriars Players played at the Great Lakes Exposition in Cleveland, Ohio from June of 1936 until October of that year; the Globe Players, the original members of the company, played at the Texas Centennial Exposition in Dallas from June until November; and the Fortune Players, a replacement company for the Globe Players, finished the season, from May, 1936 until September, 1936 at the California Pacific International Exposition at San Diego.

With the close of the expositions at San Diego and Cleveland, several of the actors there returned to the Dallas Fair to finish the season, replacing some of the actors in the original Globe Players group, who had left the group as a result of financial controversies during the summer of 1936. These replacements formed the nucleus of the Globe Theatre Company which embarked on its final tour of the Middle West in January of 1937. The tour lasted a little more than a month. It was not successful financially, and when floods in the area made it impossible for the company to reach its booked engagements, the company disbanded. It did not reassemble.

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A CRITICAL EVALUATION OF A DOCUMENTARY SERIES OF RADIO PROGRAMS ON RACIAL AND RELIGIOUS PREJUDICE

(Publication No. 5535)

Burrell Fenton Hansen, Ph.D.
University of Minnesota, 1953

In an attempt to meliorate racial and religious group antagonisms in Minneapolis and St. Paul, Minnesota during the summer of 1947, one of the major radio stations in the area originated and broadcast a series of six weekly half-hour documentary programs entitled, "Neither Free Nor Equal." This thesis reports an evaluation of the effectiveness of those radio programs in affecting attitudes and behavior in the desired direction.

Standards for evaluation of the programs as documentary broadcasts were derived from an extensive survey of the literature and synthesized into an evaluative definition. Program effectiveness was then evaluated both rhetorically and experimentally.

The experimental analysis examined the reactions of 346 college subjects, and 64 non-college subjects. College subjects took attitude tests before and after hearing three transcribed programs, made check chart ratings of like, indifference, dislike while listening to each program, and took information tests on program content immediately after hearing each program. Non-college subjects took the same tests, hearing, however, only one of the transcribed programs.

Rhetorical findings

(1) The physical characteristics and ethos of the broadcasting station, the preparation of the writers, and the production facilities employed were favorable factors toward the programs' success. (2) Need for action toward reduction of prejudice and discrimination was evident throughout the area. Metropolitan listeners were in a relatively favorable attitudinal "set" for the program. Non-metropolitan listeners were not so favorably predisposed. (3) Analysis of the occasion revealed positive and negative factors influencing listenership and receptiveness. (4) Structure and content of the programs indicated that they were generally well organized persuasively. That there were weaknesses in structure and content was attributed to the failure of the originators to perceive the basic argumentative nature of the vehicle. (5) Various technical devices of the radio presentation were analyzed and found to have significant rhetorial functions. (6) Expressed reactions of listeners to the programs as broadcast were largely affirmative. Specific points of weakness and strength were noted. Listeners frequently recommended "more such programs." Human relations agencies of the Twin Cities were positive in stating that the programs had been of practical value.

Experimental findings

(1) College experimental subjects made statistically significant shifts in attitude scores in the direction of greater tolerance after hearing three of the transcribed broadcasts. (2) Non-college subjects did not make statistically significant shifts in attitude scores after hearing one of the transcribed broadcasts. (3) The check chart ratings indicated that the programs were well liked. Sections of the programs of greatest interest and least interest were analyzed for specific factors contributing to interest or lack of interest. (4) Free response check chart comments were analyzed for identification of program features liked and not liked. (5) Results of the information tests indicated that information in the programs was acquired with a high degree of accuracy. (6) Analysis of information test results indicated the program sections well remembered and those sections not well remembered; characteristics of those sections were analyzed. (7) Inter-relationships among test results indicated that sections of the programs were very rarely rated high in all three factors of liking, interest and retention, or very rarely rated low in all three of the same factors.

Subsidiary and specific findings are reported in detail in the thesis.

The evident intention of the broadcasts was to reduce racial and religious group tensions in the Twin Cities of Minnesota. The results examined indicated that positive contributions to progress in that direction were made by the broadcasts.

Recommendations for improving documentary program effectiveness and recommendations for further research conclude the thesis.

Microfilm copy of complete manuscript of 543 pages, $6.79. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1644.

CLARICILLA, BY THOMAS KILLIGREW

(Publication No. 5614)

William T. Reich, Ph.D.
University of Pennsylvania, 1953

Supervisor: Matthew W. Black

This is a critical edition of Claricilla, a tragicomedy written by Thomas Killigrew in 1636. The text of the play is based upon the author's copy of the 1664 folio edition of his Comedies and Tragedies, containing holograph copy-corrections. Textual notes record variants in the two earlier texts of the play, a manuscript dated 1639 and a 1641 printing.

The introduction to this edition contains discussion of the texts, the date of composition, stage history, dramatic type, and attributed sources of the play, critical appraisal, and an analysis of the author's methods of revision.

Claricilla was probably written in Rome in February or March, 1636, and produced by the Queen's Company at the Phoenix Theatre in Drury Lane before May of the same year. The sole evidence of its success during the Caroline period is a reference in a prologue to a Shirley play linking Claricilla and Suckling's Aglaura as plays that "are now the mood."

The play was, however, given a surreptitious performance during the Interregnum (1653) at Gibbons' Tennis Court. Following the Restoration, Claricilla became a stock play of the King's Company. Pepys records three visits to see it — in 1661, 1663, and 1669. His final visit is the last record of its performance.

Claricilla is one of a large group of plays written, chiefly in the 1630's, by cavaliers of Queen Henrietta's Court. Although literary sources have been established for most of Killigrew's other plays, none seems to exist for Claricilla. One suggested source, the French romance Ariane, by Armand Desmarets de Saint-Sorlin, has apparently contributed little or nothing.

Claricilla survives in the three texts mentioned above. A recently-discovered manuscript, dated June, 1639, and now in the Harvard Houghton Library is the earliest of these. The play was first printed in 1641 with Killigrew's The Prisoners. The final printing of Claricilla formed a part of the publication of Killigrew's dramatic works in 1663-4. Killigrew's copy of this edition, now in the Worcester College Library, Oxford, contains autograph marginalia, revisions, and copy-corrections. The marginal notations, while frequently unclear, suggest that Killigrew planned to introduce special scenic effects, including the entrance in one scene of a large gallery or ship.

As the textual apparatus reveals, the manuscript and two printed editions of the play are independent. While the relationship of the manuscript and duodecimo is not clear, comparison of these texts and the folio edition — supported by the evidence of Killigrew's own copy of the folio — reveals Killigrew's practice in revision. His alterations show a constant effort to elevate the tone of the play, clarify expository passages, improve the diction, and meet the problems of actual performance.

In the present text of the play Killigrew's copy of the 1664 folio has been followed line for line except for the correction of a few obvious misprints. All variants between Killigrew's copy and the original folio are recorded in the critical apparatus. All evidential variants of the manuscript and duodecimo have been noted. Killigrew's marginal notes have been grouped, with explanations, following the text.

Microfilm copy of complete manuscript of 243 pages, $3.04. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1645.

SHIFT OF ATTITUDE FOLLOWING PERSUASION AS RELATED TO ESTIMATE OF MAJORITY ATTITUDE

(Publication No. 5724)

Thomas Mitchell Sawyer, Jr., Ph.D.
University of Michigan, 1953

General Hypotheses

Two major hypotheses were tested in this study. The first, sought to predict who would be persuaded by a speech by measuring the difference between estimates of the majority attitude and estimates of the speaker's attitude. It was predicted that the smaller the difference, the greater the favorable shift of attitude would be. The second major hypothesis predicted a high correlation between a single, linear measure of attitude and a multiple-statement type of attitude test.

Measures

An attitude text on Lowering the Voting Age was devised by combining the techniques of Thurstone and Likert. A linear measure of nine equal-appearing intervals with only the end points defined verbally was also employed.

Experimental Design

A group of 170 students in first year speech classes was given these two tests. The subjects were asked to indicate their own responses to the attitude statements and also to indicate their estimates of the majority's responses to the statements.

The subjects were then divided into three groups. A week or two weeks later one group heard a live speaker argue that the voting age should be lowered; the second group read a printed copy of the speech; the third group watched a telecast of the speaker. The attitude tests were then given again, but this time the subjects were asked to indicate not only their own responses and their estimates of the majority's responses, but also their estimates of the speaker's responses.

Results

The first major hypothesis was not borne out; the second was.

Conclusions

1. The 170 subjects estimated the majority attitude as significantly more favorable than their own attitudes both before and after the argument. This suggests that the majority attitude was not salient or clearly perceptible, and that the group was not cohesive.
2. The mean own attitude of the 170 subjects did not differ significantly after the presentation of the argument. However, the 60% of the subjects who shifted favorably was significantly different from the 50% which would be expected by a chance distribution of shifts.
3. The mean of persons shifting favorably was originally significantly more opposed, later significantly more favorable, than that of persons shifting opposed. However, statistical regression cannot be ruled out as the cause of these shifts.
4. By matching original scores it can be demonstrated that persons shifted favorably estimated the majority shifted favorably too, while persons shifted opposed did not.
5. Persons shifted opposed perceived a significantly greater distance between their own attitudes and the majority attitude after the argument than before.
6. Listeners perceived the speaker's attitude as significantly more favorable than did readers.

7. There was a high positive correlation (0.93) between the single, linear measure of attitude and the multiple-statement type of attitude test. The correlation dropped significantly lower to 0.84 after the argument.

8. There was a positive correlation of 0.54 between the same two measures on estimates of majority attitude both before and after the argument.

9. There was a positive correlation of 0.46 between the same two measures on estimates of the speaker's attitude.

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AN EXPERIMENT IN CONTENT ANALYSIS: THE RADIO ADDRESSES OF HENRY J. TAYLOR: 1945-1950

(Publication No. 5555)

David Wakefield Shepard, Ph.D.
University of Minnesota, 1953

Purpose

The purpose of this study is to estimate the utility of content analysis procedures in contemporary rhetorical criticism. This study develops reliable measures of content and applies them to 121 sampled broadcasts of Henry J. Taylor.

Method

A list of fifty current issues and 194 sampled paragraphs were submitted to independent coders. The symbols were to be counted as they occurred as subjects of assertions; the assertions were to be classified. After these preliminary codings the symbols were regrouped experimentally; a list of twenty-three symbols resulted. The paragraphs were submitted to new groups of coders. The results are summarized below. Reliability is expressed as a percentage of total agreement:

Group	1	2	RG	3	4	5
Symbol designation.	54	69	85	88 (88/87)*	82	78
Favorable—unfavorable.	61	74	-	89 (91/87)*	88	89
Factual, nonfactual	58	73	-	95 (93/96)*	94	93
Form of support	35	63	-	83 (85/82)*	82	85

* Split-halves reliability.

The symbol list and categories were applied to the broadcasts. The results are summarized below:

Ambiguous and excluded subjects.

Favorable	Neutral	Unfavorable	Total
1,449 (44%)	537 (17%)	1,268 (39%)	3,254 (50%)

Policies and people associated with a Democratic or liberal position.

Favorable	Neutral	Unfavorable	Total
69 (3%)	149 (7%)	1,777 (89%)	1,995 (30%)

Praise and blame of America.

Favorable	Neutral	Unfavorable	Total
459 (85%)	8 (1%)	71 (13%)	538 (8%)

Policies and people associated with a Republican or conservative position.

Favorable	Neutral	Unfavorable	Total
443 (91%)	29 (6%)	14 (3%)	486 (7%)

Education, flying saucers, etc.

Favorable	Neutral	Unfavorable	Total
119 (45%)	40 (15%)	106 (40%)	265 (4%)

Conclusions

Reliability. Agreement increases significantly with training and seems dependent upon the coders' professional backgrounds. Revision of the symbol list where there is confusion between three or four symbols and frequent retesting is advisable.

Analysis. The method contributes to the precise and verifiable description of speech content. The data permit the testing of hypotheses with reference to a speaker's subject matter and position.

The favorable-unfavorable category indicates bias and persuasive tendencies in Taylor's addresses. Taylor is favorably disposed toward Republican and conservative policies; he is unfavorably disposed toward Democratic and liberal policies. Examination of the assertions indicates inconsistencies in this constant position. This category also indicates attempts to establish ethos through praise of the good, the economical, the American.

The factual-nonfactual category furnishes some indication of emotional proof. There are different emphases on forms of support in nonfactual as contrasted with factual assertions. The forms of support category indicates the extent and variety of Taylor's use of logical proof.

There is no evidence that Taylor relies on humor or literary allusion. In criticizing the status quo Taylor blames the spenders, the socializers, the bamboozlers. The politician serves a scapegoat role in these broadcasts.

The data furnish material for speculation upon the ethical nature of the speeches: The data indicate the ends of the broadcasts; there is use of nonexperimental propositions for experimental reasoning forms; there is rigid interpretation of nonexperimental propositions; contentions that Taylor is an authority are frequently substituted for documentation; there is questionable selection where complete presentation of the facts is impossible; Taylor mixes explanation and description.

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FERTILIZATION AND ARTIFICIAL ACTIVATION IN THE EGG OF THE SURF-CLAM, SPISULA SOLIDISSIMA

(Publication No. 5572)

Robert Day Allen, Ph.D.
University of Pennsylvania, 1953

Supervisor: L. V. Heilbrunn

In the egg of the surf-clam, the germinal vesicle breaks down 10 minutes after fertilization or artificial activation. In fertilized eggs this nuclear breakdown is followed by the appearance of polar bodies at 29 and 38 minutes, and pronuclei at 50 minutes after insemination. Cleavage occurs at 71-74 minutes after insemination (21° C.). Artificial activation rarely results in clevage; instead, polar bodies (one or two) form, and the eggs stop development after an hour or two, and usually contain from one to several nuclei.

A number of parthenogenetic agents will cause activation (induce nuclear breakdown) in the eggs of Spisula. Among these agents are ultraviolet light, sodium, potassium, ammonia, osmotic stimuli, and protamine. Heat, cold and urea, which are not good activating agents for these eggs, do, however, cause marked changes of shape (wrinkles or indentations). Less pronounced changes of shape do occur when the eggs are fertilized or treated with any of the more successful activating agents. These changes of shape could not be induced in the absence of calcium. Furthermore, since it was shown that eggs thus stimulated exhibited a decrease in volume, it was concluded that a loss of water was involved. It is suggested that calcium released from the cortex of the egg by stimulating agents causes an increased gelation in the cytoplasm resulting in expulsion of water (syneresis).

Experiments with acid sea water (pH 5), lack of calcium or ether as inhibitors, indicated that a surface reaction involving calcium exerts a controlling role during the 4-5 minutes after activation, for it is during this period that Spisula eggs are sensitive to these inhibitors. It was found that excitability of the eggs could be altered either before, or up to 4-5 minutes after stimulation with ultraviolet light, by altering the environment of the egg. In this way it was possible to test the effect of various environmental factors on the activation process. It was found that monovalent cations, temperature shock, and stimulation in the cold increase excitability. Divalent ions, stimulation at slightly elevated temperatures, lowered pH, or the addition of ether, urethane or egg jelly decrease excitability. Since the period of sensitivity to excitability changes is the same as the period of sensitivity to the inhibitors mentioned above, it is suggested that reactions controlling excitability are localized in the cortex. Sodium ions and potassium ions each stimulate Spisula eggs. At normal sea water concentrations these ions antagonize one another; this antagonism may be largely responsible for maintenance of the egg in the germinal vesicle stage.

Nuclear breakdown is probably brought about by a calcium-activated enzyme; this enzyme could be either proteolytic or lipolytic.

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THE MICRODISTRIBUTION OF SOME PROTEOLYTIC ENZYMES IN THE GASTRIC MUCOSA OF SEVERAL AMERICAN TURTLES

(Publication No. 5635)

Gordon Wieland Ballmer, Sc.D.
University of Michigan, 1953

In the gastric mucosa of turtles there are two types of fundic glands, one composed of "neck" and "dark" cells and the other of "neck" and "light" cells. These glands are intermixed but those containing dark cells are the more numerous anteriorly and those containing light cells are the more numerous posteriorly in the fundus. At the pylorus are "pyloric" glands which are characterized by a type of cell intermediate in structure between dark cells and light cells.

The technique used in this investigation was a modification of that devised by K. Linderstrøm-Lang and H. Holter.

In this investigation four Graptemys geographica, three Chelydra serpentina, seven Emys blandingii, and five Chrysemys picta bellii were compared, in detail, for the intracellular distribution of pepsin, alanylglycine peptidase, and leucylglycylglycine peptidases. Breis from the above four species and also from Sternotherus odoratus, all under forced fast, were used for the determination of temperature and pH optima for their enzymes.

The results indicate that the dark cells possess the greatest peptic activity, neck cells have a lesser peptic activity, and light, surface epithelial, and connective tissue cells have no peptic activity while sections of pylorus have slight peptic activity.

In the fundus, all mucosal elements secrete peptidases, the glandular cells contributing the greatest portion. Cleavage curves of the leucylglycylglycine peptidases closely parallel the combined distribution curves of dark and light cells. Alanylglycine peptidase is similarly distributed but is also found in neck cells. In contrast to its low peptic action, the pylorus produces a relatively high amount of peptidase.

Brei experiments indicate that the turtles possess cathepsins or closely related enzymes. These also demonstrate that the turtle enzymes which were studied behave towards temperature and pH phenomena as do those of mammals.

Studies made by differential staining show that the light and pyloric cells contain mucogenic substances which differ from those found in cells of the neck and surface epithelium. Dark cells display, in the apical region of their cytoplasm, a mucogenic color reaction of the same type as that present in the neck cells, though of lesser extent.

These staining and enzymatic investigations lead me to conclude that the enzymes occurring in turtles are very similar to those of mammals but are formed by cells of a different histological type.

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THE RELATIONSHIP AMONG CERTAIN ECOLOGICAL CONDITIONS AND TROUT POPULATIONS IN THE PIGEON RIVER

(Publication No. 5638)

Norman Gustaf Benson, Ph.D.
University of Michigan, 1953

Information was collected on the ecological determinants of the density in populations of brook trout (Salvelinus f. fontinalis Mitchill) and brown trout (Salmo trutta fario L.) in the Pigeon River, Otsego and Cheboygan counties, Michigan. Chemical, physical, and biological data were collected in four study areas (each 400 yards long) during all seasons of the year in the period from June, 1950 to June, 1952. Estimated numbers of trout (collected by D. C. electrical shocker) in July, 1951, were: study area I, 1440; study area II, 737; study area III, 89; and study area IV, 1.

Dissolved oxygen (8.0 to 13.5 p.p.m.), methyl orange alkalinity (126 to 215 p.p.m.), phenolphthalein alkalinity (0.0), hydrogen ion concentration (7.4 to 8.8), phosphorus (0.000 to 0.023 p.p.m.), and specific conductance (185 to 208 reciprocal megohms) did not vary significantly among the study areas. Maximum water temperatures from March 14 to November 3, 1951, in the respective study area were: I, 67° F.; II, 76° F.; III, 78° F.; and IV, 78° F. Percentage of surface ice cover was used to indicate winter water temperatures and was greater in study areas III and IV (maximum, 100 percent) than in I (maximum, 20 percent) or in II (maximum, 75 percent). The maximum ground water seepages (recorded as percentage increase in volume of flow per mile of stream) found in the respective study areas were: I, 23.5 percent; II, 23.2 percent; III, 6.4 percent; and IV, 1.7 percent. Mean depth (9.8 to 19.5 inches), mean width (37.6 to 61.0 feet), or percentage gradient (0.057 to 0.335 percent) showed little relationship to numbers of trout. Bank and midstream cover were greatest with the largest numbers of trout; the exact relationships of cover were not determined. Bottom soil types were classified by improved means using standardized sieves and included: silt, sand, fine gravel, coarse gravel, and rubble.

Estimated winter standing crops of macroscopic bottom organisms per acre (principally Ephemeroptera, Trichoptera, and Diptera) in the respective study areas were: I, 49,189 cc.; II, 41,934 cc.; III, 23,553 cc.; and IV, 59,340 cc. Estimated total standing crops in pounds per acre of non-salmonoid fishes for each study area in July, 1951, were: I, 9.95; II 10.68; III, 20.65; and IV, 10.01. The largest standing crop of fish in pounds per acre (45.77 in July, 1951) was present with the largest trout population (1440 in July, 1951).

Lack of ground water seepage was found to be the only condition that definitely limited the density of the trout populations. Trout spawning areas were present only where ground water seepage occurred. Due to apparently limited migration of trouts, the amount of spawning determined the numbers of all sizes and age groups. Ground water seepage was determined (within limitations) by summer water temperature, winter water temperature, surface ice cover, bottom soil temperatures, and seepage runs. In conclusion, for survey work and for environmental improvement in trout streams, ground water seepage should be considered.

Microfilm copy of complete manuscript of 152 pages, $1.90. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1650.

STUDIES ON TRICHOMONAD FLAGELLATES OF AMPHIBIA

(Publication No. 5576)

Benton Wilson Buttrey, Ph.D.
University of Pennsylvania, 1953

Supervisor: D. H. Wenrich

Tritrichomonas augusta-like trichomonads were studied from 216 amphibian hosts which were collected from the United States, Mexico, Panama, Trinidad and China.

A small race 5.5-13.2 μ long is recognized in pure and mixed populations with the following morphological features: Gross form rather plump to tubular; three long anterior flagella often twice as long as the body and ending in knob-like enlargements; undulating membrane with the marginal and accessory filaments but lacking the subaccessory filament, and, with the costa, extending through the anterior three-fourths of the body; subcostal granules throughout the greater portion of the costa; axostyle with poorly developed capitulum and endoaxostylar granules, often limited to the capitulum; a relatively large pelta; and a spherical or broadly oval compact nucleus.

A new species, T. robustus, is described from twelve populations with the following characteristics:

Shape varying between plump fusiform and nearly spherical between the size ranges of 8.8-29.7 μ in length and 4.4-23.1 μ in width with means of 14.35 μ and 9.55 μ, respectively; three unequal free anterior flagella, often twice as long as the body and ending in knob-like enlargements; undulating membrane thrown into six to nine low subequal folds containing marginal, accessory and subaccessory filaments with the former continuing as a trailing flagellum; very thick costa with subcostal granules along its anterior end which forms a base of the undulating membrane, and along with the undulating membrane, often runs diagonally across the dorsal body surface from the left to the right side; thick hyaline axostyle containing endoaxostylar granules with the anterior end bent toward the ventral side; a parabasal body consisting of a long ramus 3.3-5.5 μ in length and a shorter ramus of variable length in the process of growth in preparation for division; large spherical or broadly oval nucleus 3.0-4.5 μ in diameter in the extreme anterior region of the animal; and vacuolated cytoplasm containing darkly staining siderophilic material.

The remaining T. augusta-like trichomonads consist of size races with the following morphological features: Gross shape varying between slender pyriform and oval with size ranges of 5.5-34.1 μ in length and 2.2-15.4 μ in width and means of 16.38 μ and 6.06 μ; blepharoplast of a group of granules embedded in a matrix; three unequal free anterior flagella arranged with two being in closer association throughout their lengths; undulating membrane containing marginal, accessory and subaccessory filaments with the marginal filament continuing beyond as a trailing flagellum and ending in a narrow axoneme; a thin thread-like costa at the base of the undulating membrane; hyaline rod-like axostyle expanded into a broad and flat anterior capitulum, terminating in a tip often of great length and containing endoaxostylar granules; crescent-shaped pelta with fibril; parabasal body consisting of a ramus with fibril and duplicating itself during cell division by forming one new daughter parabasal body; an oval nucleus containing an endosome; cytostome with a darker staining "roof of the mouth" area; and cytoplasm varying between a granular to a vacuolated condition.

Use of protein-silver technique aided greatly in the study of the subaccessory filament in the undulating membrane, flagella, parabasal body and the pelta.

Microfilm copy of complete manuscript of 101 pages, $1.26. Enlargements 6" x 8", 10¢ per page Library of Congress card number MicA53-1651.

GENETIC STUDIES ON Paramecium aurelia: PART I. THE GENIC BASIS OF MATING TYPE DETERMINATION AND DEVELOPMENT IN THE VARIETIES OF Paramecium aurelia BELONGING TO GROUP A. PART II. THE EFFECTS OF COLCHICINE ON Paramecium aurelia. PART III. A MORPHOLOGICAL MUTANT OF VARIETY 1 OF Paramecium aurelia.

(Publication No. 5856)

Henry M. Butzel, Jr., Ph.D.
Indiana University, 1953

Although the paired mating types of each variety of P. aurelia are homologous, the sexual reactions are highly specific and the homologous types in each variety are as distinct as homologous sexes in different species of related higher organisms. The first problem investigated is the basis of this specificity.

The two mating types in a variety are known to be genically identical, but the basis for the development of these different hereditary traits by animals possessing genes is unknown. The second problem investigated is thus a special case of the problem of how cells become permanently diverse during development of multicellular organisms.

A. Varietal Specificity

It has been demonstrated that the simplest explanation of the restriction of a stock of variety 7 to the odd mating type (XIII) is that it contains a recessive gene probably allelic to a similar recessive gene in a stock of variety 1 also restricted to the odd mating type (I).

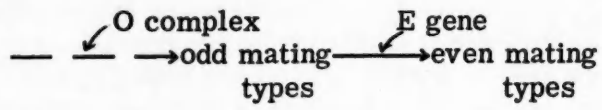
The apparent allelism of these genes restricting stocks of the two varieties to homologous odd mating types might indicate that these same genes determine varietal specificity of the mating reactions. This is excluded by additional data, previously known and here confirmed; mating type XIV appears in hybrids between the variety 7 stock pure for type XIII and a stock of variety 1 pure for a gene permitting development of both types I and II. (This gene is also allelic to the genes previously discussed.)

The allelism and similar action of the gene for pure odd mating type in the two varieties as well as the development of type XIV in the hybrids may be accounted for by the following hypothesis: a complex of genes (the O complex) controls development of odd mating types, and a single gene, E, controls development of even mating types. Similar or identical genes occur at these loci in all varieties. Pure odd types carry a relatively inactive allele, e, at the E locus. Specificity of mating types in different varieties depends upon genes at one or more loci, the var genes. Hybrids developing type XIV do so by interaction of the E gene from variety 1 and var genes from variety 7. Variety 1, lacking the proper var genes, cannot produce type XIV; variety 7, lacking the E gene also cannot produce type XIV.

B. Development and Determination of Mating Type

1. Development

Two natural stocks pure for odd mating types are known (see previous page), but none pure for even mating type exist. Effort to induce mutations of mating type have yielded two new pure odd types from a stock originally able to develop both mating types. No mutant pure for an even mating type was obtained, suggesting that mutations specifically blocking development of odd mating types cannot occur, and that the O complex and E gene act successively in the development of mating type according to the following scheme:



2. Determination

Another gene, independent of the E locus, has been shown to act to increase the frequency of odd mating types in stocks of variety 1 containing the gene permitting both mating types to develop. Similar increase in the frequency of type I results from exposing cultures to 2,4,dinitrophenol during and after mating.

In view of these and previous data, it is postulated that the alternative between determination of type I vs. type II is cultures genically able to produce both is settled by the activation or inactivation of gene E products at an early sensitive period in the origin of the clone. Genetic and environmental conditions influence the frequency of activation as shown.

Microfilm copy of complete manuscript of 158 pages, $1.98. Enlargements 6"x 8", 10¢ per page. Library of Congress card number MicA53-1652.

ORIGIN OF THE LAND AND FRESHWATER MOLLUSK FAUNA OF THE BAHAMAS, WITH A LIST OF THE SPECIES OCCURRING ON CAT AND LITTLE SAN SALVADOR ISLANDS

(Publication No. 5653)

William James Clench, Ph.D.
University of Michigan, 1953

This study deals with the origin of the Bahama land and freshwater mollusks. It is believed that the present fauna of the Bahama archipelago possibly dates only from the Pleistocene and that it has reached these islands by fortuitous means. If at any previous time a land connection existed between the bahamas and the islands to the south, such a connection disappeared, the islands were submerged, and since their emergence, there has been no further land connection.

Certain genera such as Cerion and Hemitrochus reached the islands at least during the active period of dune formation, presumably at a time when the islands were larger than now.

The present land and freshwater mollusk fauna is disharmonic and as such, would indicate an origin by means other than any land connection. This fauna of the Bahamas is composed of species from Cuba, Hispaniola and southern Florida, and a genus, Schasocheila, which is known to occur only in Central America and Mexico. Most endemic species and species groups of the Bahamas are closely related to species in Cuba and Hispaniola. The proximity of islands to one another rather than the probable geological connections between such islands, explains the faunistic relationships, and these relationships would indicate a mechanical rather than a previous normal migratorial distribution.

A list of the land and freshwater mollusks occurring on Cat and Little San Salvador Islands is given with the original citation for each species, notes and localities at which they were obtained. In addition descriptive details are given about these two islands, the general surface features, ecological areas and geological notes.

The material studied from Cat and Little San Salvador Islands consisted mainly of specimens obtained by the author and associates during a visit of five weeks to the islands.

A brief history is given of the various collectors and the islands visited in this archipelago.

Microfilm copy of complete manuscript of 79 pages, $1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress card number Mic A53-1653.

AN ECOLOGICAL STUDY OF THE RIO SABINAS AND RELATED WATERS IN SOUTHERN TAMAULIPAS, MEXICO WITH SPECIAL REFERENCE TO THE FISHES

(Publication No. 5526)

Rezneat M. Darnell, Ph.D.
University of Minnesota, 1953

The work has reviewed existing knowledge of the geography, geology, climate, and general biotic relations of the Rio Sabinas area in east-central Mexico. General physical and chemical characteristics of the stream were discussed on the basis of information obtained during the study. The biota of the Rio Sabinas and associated waters was described and considered under the following topics, major floodplain plants, rooted aquatic plants, plankton, bottom fauna, and fishes.

Five major community types were distinguished, largely on the basis of bottom fauna, and each was discussed in relation to the physical environment and to other community types. These were as follows.

Type I was characterized by Calliergon, Pachychilus, Hyalella, Tricorythodes, and Neoperla. This was found to be of local distribution upstream in clear, swift, shallow water on flat limestone bottom. No fishes were present and little exogenous organic material was noted.

Type II contained Pachychilus, Atya, Corydalus, Chimarra, Baetidae, Hydropsychidae, Simuliidae, and Nymphalinae. Cichlasoma steindachneri was the

only fish which frequented this community type. This was of local distribution upstream in clear, swift, shallow water in boulder riffles. Few producers were present, and most of the food was washed in from upstream.

Type III was characterized by Sphaeriidae, Cochliopa, Ferrissia, and Chironomidae and the fishes, Mollienesia sphenops and Gambusia regani. This type was found to be widespread in slow, shallow-water pools and backwaters on silt, mud, and ooze bottoms. It varied in details from place to place. Gambusia vittata and Dionda rasconis were added at edges of the current, Xiphophorus variatus in still water, Astyanax fasciatus and Herichthys cyanoguttatus at edges of deeper water, and Cichlasoma steindachneri, Ictalurus punctatus, Gobiomorus dormitor, and Macrobrachium carcinus, often at night. This was the major shallow-water community type of the area, and it was trophically dependent upon plankton, rooted aquatic plants, and exogenous organic material.

Type IV was not sampled directly, but was indicated by the presence of large fishes, Ictalurus punctatus, Herichthys cyanoguttatus, and Carpiodes sp. and by Macrobrachium carcinus. It appeared to be widespread in the middle portion of the Sabinas in deep, clear, slow-flowing pools in association with silt bottoms. This was trophically dependent upon plankton, exogenous organic material, and upon other community types.

Type V was characterized by Hexagenia, Gomphoides, and Chaoborus. This was the downstream type found in deep, turbid, slow water with fine-particled silt or ooze bottom. No fish collections were made, but observation of predatory Lepisosteus sp. clearly indicated the existence of other species.

Although five community types were distinguishable, plankton and several species of invertebrates and fishes were shown to affect more than one community type, integrating them into a single major stream community. This integration was brought about largely through trophic relationships.

Physical gradients and habitat distribution were analyzed in an attempt to clarify casual relationships involved in stream development and maturation. It was concluded that maturation of the Sabinas involved trends toward (1) greater independence of immediate surroundings, and (2) greater dependence upon upstream influences, for which the river itself appeared largely responsible.

The ecology of each species of fish was treated in some detail. Food habits were briefly compared and a morphometric index (ratio of gut length/standard body length) was introduced and considered as an aid in the comparison of food habits. The applicability of this ratio as an index of biological efficiency was reviewed in light of Lindeman's work.

Zoogeographic relations of several community components were considered.

Microfilm copy of complete manuscript of 210 pages, $2.63. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1654.

RELATIONSHIP BETWEEN BOTTOM FAUNA AND PRODUCTION OF LARGEMOUTH BASS, MICROPTERUS SALMOIDES (LACÉPÈDE), IN THE ABSENCE OF COMPETING SPORT FISHES

(Publication No. 5661)

Gerardus Cabble de Roth, Ph.D.
University of Michigan, 1953

Material on which this study is based was collected from two small lakes in southeastern Michigan during 1950, 1951 and the spring of 1952. The original fish populations were eradicated using powdered derris root and, after the water had become non-toxic, both lakes were restocked with largemouth bass and golden shiners.

Bottom samples were taken with an Ekman dredge and average standing crops of invertebrate bottom fauna estimated on the basis of actual productive bottom areas in both lakes. Average standing crops of bottom organisms were 72.9 and 28.8 pounds wet weight per acre in Parks Lake and Lake Bel-Aire, respectively. Methodology was discussed and the reliability of procedures used in this study was validated statistically.

In order to estimate the original amounts of bottom organisms and other food eaten by largemouth bass, a restoration method was developed for treating the contents of fish stomachs. Utilizing the invertebrates collected in bottom samples, data on which this method is based were developed as follows: Each of the groups of organisms having a considerable size-range (i.e., Ephemeroptera, Zygoptera, Anisoptera) was divided into three or four size-groups, and an average dry weight in milligrams was determined for each group. For each kind of animal which had little variation in size (i.e., Amphipoda, Hydracarina, Chaoborus, etc.) only one average weight was calculated. To analyze the food eaten by largemouth bass, the organisms found in the stomachs were tallied by group frequencies, and the restored total weights of each kind were then estimated by multiplying the average group-weight by the frequency of organisms within that group. By using this method it was possible to estimate the original weights of ingested food by examining the partially digested or fragmentary remains of organisms found in the alimentary tracts of largemouth bass.

The types and quantities of food eaten by bass in the two experimental lakes were compared to the types and quantities of food available in the two habitats by means of the forage ratio. The forage ratios varied from 0.04 to 33.6 with values greater than one for Ephemeroptera, Zygoptera and Anisoptera in Parks Lake and Ephemeroptera, Zygoptera and Chaoborus in Lake Bel-Aire. For other invertebrate groups represented in the bottom fauna, forage ratios were less than one.

Average restored weights of food in bass stomachs, expressed as percentage of the body weight, (1.29 and 0.70 in Parks Lake and Lake Bel-Aire, respectively), were shown to be related directly to the growth of largemouth bass.

It was found that the golden shiner did not serve as forage for largemouth bass; rather, the mudminnow, which survived the Rotenone poisoning, comprised over 90 percent of the fish found in bass stomachs.

Using data collected from each of several small lakes in southeastern Michigan, the weights of the average standing crops of bottom fauna were compared to the weights of the average standing crops of fishes. The resulting fish food to fish ratios varied from 1:2.7 to 1:21.0.

It was shown that the species composition of a fish population determines, in part, the magnitude of the standing fish crop. As the proportion of coarse fish increases, the total standing crop also increases; likewise, as the proportion of coarse fish decreases, the total standing crop of fish decreases until, in the absence of coarse fish, the standing crop is about 150 pounds per acre.

Two methods were developed for predicting largemouth bass production in the absence of competing fishes. Method I was based on the theoretical conversion of the total annual yield of bottom fauna directly into fish flesh. To arrive at this estimate, the percentage of invertebrate bottom organisms found in the fish stomach contents and an average food to fish flesh conversion ratio were used. Estimates varied from 58 to 185 pounds of fish per acre. Method II was based on the previously derived estimate of 150 pounds of fish per acre when bass are the only species of fish present in a body of water. Results from the application of these methods to data from three nearby lakes showed good agreement, whereas, for the fourth body of water, results varied considerably. These procedures for estimating bass production were evaluated and an improved index was proposed. It differs from those employed in that it incorporates a more complete consideration of items in the diet, notably crayfish.

Microfilm copy of complete manuscript of 102 pages, $1.28. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1655.

STUDIES ON THE BIOLOGY OF PHYSA GYRINA SAY: ECOLOGY AND LIFE HISTORY

(Publication No. 5662)

Robert Merkle DeWitt, Ph.D.
University of Michigan, 1953

The life history and ecology of Physa gyrina were studied in three ponds in Michigan. In a semi-permanent pond in southern Michigan, oviposition occurred in the spring when water temperatures reached 10 to 12 degrees Centigrade, and the adult population died shortly thereafter. Snails born in the spring may reach sexual maturity that fall, but most oviposition is delayed by low temperatures until the following spring. The life history in a semi-permanent pond 300 miles north of the above-mentioned pond differed only in that oviposition took place three to four weeks later in the spring.

Estivation forced upon snails inhabiting temporary ponds delays growth, and these rarely attain sexual maturity by the fall of the year in which they hatch. The time to reach maturity the following spring is dependent upon the length of estivation the preceding summer.

The time needed for development of the embryo varies indirectly with temperature. At room temperatures (20 - 23° C.) hatching occurred about seven days after the eggs had been laid.

Growth in P. gyrina is not determinate but continues throughout the life of the individual. Post-embryonic growth of the shell is most rapid along the longitudinal axis during the first fourteen weeks after birth, while lateral expansion of the shell characterizes growth during the remainder of the life span. "Rest marks" on the shell were concluded not to be dependent upon environmental factors, but rather the result of a physiological pattern developed within the species.

Laboratory reared P. gyrina had a longer life span than did those living in their natural habitat, and the seasonal periodicity of oviposition, which exists in the field, had a tendency to disappear in the laboratory. A definite positive correlation existed in all snails between the length of the shell at time of oviposition, and the total number of eggs laid. In the laboratory, a high egg production appreciably shortened the individual's life. The total egg production per snail was much higher for those individuals reared in isolation than in communally raised snails, but the percentage of hatching of "virgin" eggs was much lower than in eggs produced by snails reared together. The highest percentage of hatching occurred in eggs obtained from snails collected in the field.

Physa gyrina can successfully reproduce through self-fertilization for one generation in the laboratory. The second generation reared in isolation, exhibited a great decrease in percentage of viable eggs.

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THE MORPHOLOGY AND TAXONOMY OF THE INTESTINAL PROTOZOA OF THE AMERICAN WOODCHUCK MARMOTA MONAX, LINNAEUS

(Publication No. 5591)

James Russel Gabel, Ph.D.
University of Pennsylvania, 1953

Supervisor: D. H. Wenrich

Fourteen specimens of Marmota monax were examined for intestinal protozoa and ten species of Protozoa are described. Preparations were fixed with osmic acid fumes, Flemming's, Schaudinn's, Bouin's and Hollande's fluids and stained with Heidenhain's,

Delafield's and haemalum haematoxylin, Giemsa and silver-protein techniques. Transfaunation experiments were carried out from woodchuck to hamster resulting only in the transference of Entamoeba.

Retortamonas kirbyi n. sp. occurred in one host specimen. The trophozoite and cysts are described and comparison is made with other rodent species reported by other authors.

Chilomastix instabilis Crouch was present in six of the hosts examined. The morphology of the trophic and cystic stages is described and a brief comparison is made with other species reported from related rodent hosts.

Monocercomonoides digranula (Crouch) is reported from ten of the hosts examined. A description of the species is accompanied by a comparison with similar species described from other rodents and this organism is placed in the genus Monocercomonoides rather than Trichomonas as first described.

Monocercomonoides robustus n. sp. was found in eight of the fourteen host specimens examined. The morphology is described and a comparison is made with the other species present in the woodchuck.

Hexamastix cryptonucleata (Crouch) occurred in three of the host specimens. Its morphological features are described and the organism is reclassified from Trichomonas to Hexamastix.

Paratrichomonas (n. gen.) marmotae (Crouch) was the most common protozoan found in the woodchuck appearing in thirteen of the fourteen hosts examined. The new genus was created because of the morphological differences from Donné's genus Trichomonas and from species of Tritrichomonas. The morphology of the organism, a process of division of the parabasal body, and a condition resembling pseudoencystation is described.

Tritrichomonas wenrichi (Crouch) occurred in six of the hosts examined. It is characteristic of the genus Tritrichomonas created by Kofoid with T. augusta as type species. Pseudocysts are reported. Comparison is made with previous descriptions of T. wenrichi and with T. muris and T. caviae showing that these are three distinct species.

Hexamitus teres Kirby and Honigberg is reported from four of the hosts examined. Its morphology is described.

Octomitus pulcher (Becker) was found in ten of the fourteen hosts examined. Its morphology is described and comparison is made with similar organisms from other rodent hosts and the taxonomic position is briefly discussed.

Entamoeba marmotae Crouch is described from seven of the host animals. It is non-pathogenic as far as can be determined. The morphological features are discussed and the close resemblance to E. muris is pointed out.

Sphaerita is reported from nine of the protozoan species described from the woodchuck. Nucleophaga was found in Tritrichomonas wenrichi.

The reason for the creation of the new genus Paratrichomonas is discussed. The suggestion is made to divide the genus Trichomonas into six separate genera: Trichomonas, Tritrichomonas, Pentatrichomonas, Pentatrichomonoides, Pseudotrypanosoma and Paratrichomonas.

Microfilm copy of complete manuscript of 124 pages, $1.55. Enlargements 6" x 8", 10¢ per page. Library of Congress card number MicA53-1657.

MODES OF ACTION OF ANTIBIOTICS IN RELATION TO GROWTH OF TETRAHYMENA

(Publication No. 5673)

Jean Alvah Gross, Ph.D.[1]
University of Michigan, 1953

Knowledge of the mechanisms of action of drugs is important for a clear understanding of their possible uses. Little is known of the modes of action of the antibiotic drugs, chloromycetin (CM), aureomycin (AM), and terramycin (TM). The present investigation was undertaken in an attempt to learn something of the action mechanisms of these antibiotics.

Growth of the ciliate protozoan, Tetrahymena pyriformis, strain E, was used as the index of activity. This microorganism was grown in a completely defined synthetic medium (initial pH 6.5), modified from that of Elliott (1949, 1950). The Lumetron Colorimeter, Model 401, with a red (650 mμ) filter was employed to measure growth turbidimetrically. Cultures were grown in the dark at 25° C. (except for temperature experiments) with tubes in vertical position. Antibiotics were prepared in concentrated solutions, and added in measured amounts to the culture medium to yield the desired final concentrations. The drugs were sterilized by filtration through Büchner type, all-glass filters with fritted discs.

Lethal concentrations for all three antibiotics were determined. Concentrations of the drugs which resulted in 50% inhibition of growth at four days were found to be 1.9×10^{-5}M AM, 12.4×10^{-5}M CM, and 8×10^{-5}M TM, These concentrations were used in exploratory studies of biochemical actions. The antibiotic levels which yielded 50% inhibition of the rate of growth were 5.8×10^{-5}M AM, 31×10^{-5}M CM, and 15×10^{-5}M TM. These levels were obtained by measuring slopes during the log growth phase. Such information was employed in physicochemical analyses.

It was found that CM and TM suppress growth of only actively growing cultures, while AM acts against cells in the lag phase as well as in the exponential phase of growth. Under the experimental conditions, it was demonstrated that AM decomposes rapidly, while the other two antibiotics are quite stable, and that the organisms neither produce an AM-destroying enzyme nor adapt to AM.

No relationship could be shown to exist between any of the antibiotics and the Krebs Cycle. Data were obtained which show that all three drugs seem to block the metabolism of Mg^{++}.

Inhibition data, which were analyzed by applying the law of mass action and the theory of rate processes, indicate that all three antibiotics have a double action on the growth rate of Tetrahymena. This type of activity suggests that each of the drugs act on two different enzyme systems, or have a multiple action on the same enzyme. Studies of thermal relationships

reveal that the antibiotics increase in activity as temperature rises, and therefore, may be classified as Type II (non-competitive) inhibitors (Johnson et. al., 1942; McElroy, 1943, 1951; and Lardy, 1949).

1. United States Atomic Energy Commission Predoctoral Fellow in the Biological Sciences.

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IN VITRO STUDIES ON THE RELATIONSHIPS BETWEEN GLUTATHIONE, INTERMEDIN AND MELANIN SYNTHESIS

(Publication No. 5690)

Robert Rothenberg Kohn, Ph.D.
University of Michigan, 1953

It has been reported that when the pituitary melanophorotropic hormone intermedin is present in large amounts in vertebrate test animals, there is an increase in melanin in the skins of the animals. Past experiments on the effect of intermedin on melanin production in vitro have been inconclusive. This investigation was undertaken to discover if intermedin had a stimulatory effect on the series of enzymatic reactions leading to the formation of melanin.

Intermedin preparations, organ extracts, and physiological inhibitors of melanin synthesis were added to various melanin-forming systems, and the reactions were followed manometrically and colorimetrically. No organ preparations had a significant effect on uninhibited melanin-forming reactions. Extracts from hog pituitary gland, heart, kidney, and liver which were prepared by a method for the purification of intermedin, reversed glutathione inhibition of mushroom tyrosinase-tyrosine, mushroom tyrosinase-dopa, crustacean phenolase-catechol, squid epidermis phenolase-catechol, and mouse melanoma tyrosinase-dopa systems. Reversal of inhibition was due to oxidation of glutathione by a substance in the organ preparations. This substance was shown to be a contaminant, probably an organic peroxide, from ether used as a precipitating agent in preparing the organ extracts.

A potent intermedin preparation was chromatographed on paper. Testing eluates by a new intermedin assay technique demonstrated that the hormone activity was concentrated in two widely separated peaks and that the greatest amount of activity was associated with a small ninhydrin-positive peak. No oxidizing activity was detected in the eluates, but a reducing activity was concentrated in one peak, widely separated from the main peak of intermedin activity.

It can be concluded that the hormone intermedin has no direct effect on melanin synthesis.

Evidence is presented which indicates that glutathione inhibits melanin synthesis by interfering with some step in the oxidation of tyrosine to dopa, rather than combining with the copper of tyrosinase, reducing dopa quinone, or combining with dopa quinone.

Preparations were obtained from invertebrate sources which catalyzed the oxidation of catechol, but not that of tyrosine, even in the presence of catechol.

An excess of cupric ions added to the tyrosinase-tyrosine system stimulated dopachrome production but inhibited oxygen uptake.

The possible role of intermedin in melanin synthesis in vivo and the general question of hormonal control of enzyme action are briefly discussed.

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THE FEEDING MECHANISM OF THE SEA LAMPREY, PETROMYZON MARINUS LINNAEUS, AND ITS EFFECTS ON HOST FISHES

(Publication No. 5695)

Robert Earl Lennon, Ph.D.
University of Michigan, 1953

The study of the mechanism which enables a sea lamprey to pursue its brief parasitic existence and its effects on host fishes in Lake Huron constituted an integral part of the Sea Lamprey Investigations conducted at the Hammond Bay Fishery Laboratory by the U. S. Fish and Wildlife Service. The feeding mechanism and predatory habits of the sea lamprey have extensive and complex effects on host fishes which are not always lethal, but are invariably serious. Prey specimens may survive the direct influences of attacks and then succumb to one or more secondary effects. Comparative observations were obtained from lampreys and their prey in Lake Huron and in laboratory aquaria.

The feeding mechanism consists of the buccal gland system, the armed tongue, the tooth-studded oral disc and the suctorial mouth. The secretion of the buccal glands, which bathes the wound of a victim fish, possesses a property for inducing lysis in the torn tissues, in addition to its anti-coagulant and hemolytic powers previously described. A method for the aspiration of secretion from the glands and the average yield per lamprey are described. The development of the rasping tongue and its cutting armament is reviewed and enlarged upon in respect to the relative efficiency of the organ in the fall and spring, downstream migrants. The size of the oral disc, a part of the powerful suctorial apparatus, bears a direct relationship to the length of the lamprey; consequently, the measurement of its imprint on a host fish makes it possible to estimate closely the size of the parasite responsible for any particular wound. From the onset of the 12 to 16 months of parasitic feeding accomplished by a single year class of lampreys, the wounds they create on prey increase in average diameter by 262 percent, whereas the animals increase in length about 300 percent. Well defined marks ranged from 12 to 50 millimeters in maximum diameter, caused by parasites of 5 to 23 inches in length.

The parasite-host relationships between sea lampreys and 11 species of prey fish were under observation in the laboratory aquaria. The effects of lamprey attacks on fishes, both in aquaria and in the lake, were ascertained from the examination of a total of 2,879 wounds on 20 species of fish. Most attachments on experimental hosts were situated on the upper (dorsal) half of the middle third of their bodies whereas in nature, most attacks occurred on the lower (ventral), middle third. Non-feeding attachments were noted in 9.2 percent of the 2,979 attacks. In a sample of 1,189 lake-incurred wounds, only 22.2 percent were healed or healing. In aquaria, some lethal attacks were inflicted upon hosts in as little as 4 hours; others required up to 9 days or longer to reach the same conclusion.

No type of fish tissue was wholly impervious to injury by the parasite. Hematological tests on eastern brook trout, brown trout, rainbow trout and white suckers demonstrated that the volume and constituents of blood are drastically altered in mortal attacks by sea lampreys. An average of 1,159,256 erythrocytes per milliliter and 8.24 grams of hemoglobin per 100 milliliters of blood was found for 119 normal white suckers. Post-attack blood samples in 119 dying specimens of the same size and species averaged 189,705 red cells per milliliter and less than 3.75 grams of hemoglobin per 100 milliliters. The reduction of the erythrocytes by a net 83.64 percent and of hemoglobin by at least 54 percent appears to be the lethal factor.

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STUDIES ON THE GENUS ORCHESTOIDEA (CRUSTACEA: AMPHIPODA) IN CALIFORNIA

(Publication No. 5803)

John Irving McClurkin, Jr., Ph.D.
Stanford University, 1953

A study was pursued on the ecology of three species of the amphipod genus Orchestoidea. Collection of many molting individuals and comparison of various parts of the cast exoskeleton ("skin") with the individual which emerged from it enabled the specific determination of immature instars. It was found that each specimen burrowed into the sand to molt and then ate its old skin as soon as it was able to do so. Individualized specimens were cultured for collection of most molts, but some were taken directly from the beach.

Difficulties in determining developmental stages of three mixed species of the same genus are discussed, and an attempt is made to select constellations of characters to define each of several early instars of each species, changing key characters from instar to instar as needed. Detailed descriptions are presented of proportions and spinous armature of each joint of each appendage (except antennae) of the largest and smallest adult male and female specimen found of each species. Similar analyses are made of the first instar of each species, but these are condensed by making cross-comparisons with each other. It was found that first-instar specimens of the three species were recognizably different from each other in body size, spine counts, and certain appendage proportions.

Analysis of a large field sample of one species is made in an attempt to segregate instars empirically. Tables of data are presented depicting the dimensions of various selected characters, both from solitary specimens and from pairs of skins (molting specimens). Analysis of these data indicate the extent of individual variation, the tendency of data within an instar to group around a mean, and the slight degree of overlap of adjacent instars at their extremes.

Observations on some of the edaphic factors of the environment and their effect on some general habits of Orchestoidea are presented.

Detailed studies were made of the molting process because of its intimate association with growth and, in the female, with reproduction. Molting can be watched in detail in culture and requires only a few minutes for any particular individual to complete.

Mating of all three species occurs in burrows in the sand during eight or nine months of the year, seemingly without any preliminary courtship or contact between members of a pair prior to their joint occupancy of a burrow. Females always molt just before mating, but males do not. Males do not clasp females or carry them as do aquatic species, nor as do the terrestrial forms Orchestoidea pugettensis and Orchestia traskiana. Use of the gnathopods seems to be of no particular significance during the mating process. Uropods were found to perform the function of transferring sperm, a use not previously known for them. No spermatophore was seen, but many amorphous masses of sperm were found. Means are given for recognizing specimens which are physiologically and morphologically mature. Differential nocturnal habits of fertile females are indicated.

Color changes in developing eggs are described briefly, those of each species being different from the others. Hatching of the eggs, which process reveals a function of the telson not previously known, is described in detail.

A brief description of the reproductive systems of both sexes is given. Correlated studies of the primary reproductive system and of secondary sex characters, especially of the male hand and second antenna, provided a basis for drawing conclusions on certain taxonomic problems which previously had necessarily remained controversial and speculative. Finally, a basis for better taxonomy of these animals is suggested.

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THE FOOD HABITS OF THE NORTH PACIFIC FUR SEAL IN JAPANESE WATERS, WITH A STUDY OF THE FISHES FOUND ON THE FEEDING GROUNDS

(Publication No. 5805)

Giles Willis Mead, Jr., Ph.D.
Stanford University, 1953

The study was an analysis of the relationships existing between the North Pacific fur seal (Callorhinus ursinus) while wintering off Japan, the marine organisms on which it feeds, and the Japanese commercial fisheries. It was part of the survey designed to collect information on which an international agreement for the protection of the seal could be reached among the countries bordering the North Pacific.

The stomach contents of 2312 seals which were killed pelagically of northeastern Honshu and southeastern Hokkaido between February and June, 1952, were analyzed. The weight, volume and species complement in each of the stomachs was recorded. A survey of the pelagic fishes was accomplished through the mid-water trawling of specimens in areas frequented by the seals.

The stomach contents constituting the sample were composed largely of seven species: Notoscopelus japonicus (a lantern fish, 60 percent by volume of the stomach material examined), Ommastrephes sloani pacificus (17 percent), Watasenia scintillans (eight percent), Engraulis japonicus (eight percent), Oncorhynchus sp. (two percent), Scomber japonicus (one percent), and Cololabis saira (one percent). More than 15 additional species were represented in lesser amounts.

Geographical and temporal changes in food habits are discussed.

Two lines of evidence demonstrate that most of the feeding occurs at night. The first of these is the higher percentage of empty and trace stomachs during progressively later hours of the day, and the average volume of stomach contents vs. time of day regression. The second is the diurnal activity of the three food items of greatest importance. These three species undergo vertical migrations and occur in surface waters only at night. Two are strongly luminescent and hence vulnerable to predation at night. Anchovy, mackerel and salmon are shown to be subject to predation primarily during the day.

Since the seals feed most actively at night but can be collected only during daylight hours the food complement by species estimated through stomach examinations do not represent accurately the food consumed. The percentage composition was recalculated on the basis of fresh weight and is believed to represent closely the average daily consumption of the various species: lantern fishes (primarily Notoscopelus japonicus), 68 percent; Ommastrephes sloani pacificus, 22 percent; Watasenia scintillans, nine percent; all other, one percent.

Of these three species, only Ommastrephes sloani pacificus is of major commercial importance. A decline in abundance due to seal predation cannot be substantiated. Watasenia scintillans is landed in small quantities but is of negligible economic importance. Notoscopelus japonicus is not only of no direct commercial importance but has heretofore never been reported within 360 miles of the sealing grounds. It was also suggested that the representatives of this species which occur in areas frequented by the seals may be carried to their death in the cold North Pacific by the warm Kuroshio current.

The mid-water trawling was done primarily to obtain lantern fishes for use in the identification of stomach contents. It provided noteworthy ichthyological data as well. The collection contained a large number of warm-water forms. Their occurrence farther north than most warm-water littoral forms was explained on the basis of available hydrographic data. Three of the species encountered were previously unknown. They were described and their relationships were discussed.

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LIFE HISTORY STUDY ON ECHINOPARYPHIUM FLEXUM (LINTON 1892) DIETZ 1910 (TREMATODA: ECHINOSTOMIDAE)

(Publication No. 5706)

Haig Hagop Najarian, Ph.D.
University of Michigan, 1953

The life cycle of Echinoparyphium flexum (Linton 1892) Dietz 1910 was established experimentally in the laboratory and all stages described.

A natural definitive host is the blue-winged teal, Anas discors. The small intestines of two out of eight ducks shot in a woods-pool area, about six miles west of Ann Arbor, Michigan were infected with the adult worm. The chick was used as an experimental definitive host.

A natural snail host is Lymnaea palustris. Of 3,755 specimens collected and individually isolated, 83 or 2.2 per cent were infected with the cercaria. Infected snails shed 900 - 1300 cercariae within a twenty-four hour period. In the laboratory, the bulk of shedding occurs between the hours of 1:00 P.M. and 4:00 P.M.

The metacercaria occurs both in the kidneys of frogs and tadpoles and in the kidney and heart of Lymnaea palustris. The cysts occur in the following species of frogs: 108 Rana sylvatica, 75 per cent infected; 9 Hyla crucifer, 88 per cent infected; 8 Pseudacris nigrita triseriata, 25 per cent infected; 7 Rana pipiens, 42 per cent infected; and 41 Rana clamitans, 14 per cent infected.

Attempts to infect adult frogs by exposure to cercariae were unsuccessful. Tadpoles of the same species were easily infected. The metacercaria in the frog kidney is apparently the result of the cercaria entering the tadpole and remaining in the kidney until metamorphosis is complete.

Experimentally, the cercaria encysts in the snails, L. palustris, Physa gyrina, and Gyraulus parvus.

The feeding of infective metacercariae to chicks gives only a 1.1 - 1.6 per cent yield of worms.

The eggs leave the uterus of the worm in an uncleaved condition. Eggs incubated in aerated tap water at room temperature during May - September, 1952, hatched in 10 - 14 days. The ciliated epidermal plate formula of the miracidium was 6-6-4-2 (= 18 plates).

The miracidium penetrates young specimens of L. palustris and within seven hours is located within the heart of the snail. The transformation of the miracidium into a sporocyst is completed within 24 hours.

Mother rediae develop from the sporocyst and are first seen within the snail heart at nine days. They migrate, apparently via the snail circulatory system, and occur in the digestive gland and ovotestis at 10 - 12 days. Here, they produce large numbers of daughter rediae.

The daughter rediae are avid eaters and in many cases reduce the digestive gland of the snail to about one-fifth its usual mass. In one specimen, 1,647 daughter rediae were recovered from the snail.

A single case of "partial twinning" of a mature daughter redia was observed.

Recognizable cercarial embryos develop within the daughter rediae at 33 days. The cercariae emerge from the snail via the respiratory aperture. The total time from exposure of the snails to the miracidia to the first emergence of cercariae from the respiratory aperture is 40 - 46 days.

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POPULATIONS, ECOLOGY, AND MANAGEMENT OF MARGINAL TROUT STREAMS IN SOUTHERN MICHIGAN

(Publication No. 5716)

Virgil Stewart Pratt, Ph.D.
University of Michigan, 1953

The purposes of this study were to measure the success of the trout-stocking program of the Michigan Department of Conservation in four selected southern Michigan streams and to evaluate the influence of certain environmental features on the ability of these waters to support and produce trout.

In the first part of the study, a census method and equipment therefor, suitable for stream fishes, were developed and tried. Electrical fish shockers and electrodes of various shapes and sizes were tested and their respective electrical fields produced in water were plotted. Comparison of the efficiency of alternating-current and direct-current shockers under differing stream conditions showed a much smaller fish mortality caused by direct current, but the superiority of this unit over the alternating-current shocker in collecting fishes was unquestionable only in swift and muddy waters.

In the second part of the study, selected ecological features of the environment were related to size and species composition of the estimated fish populations in six stream study sections. Environmental features considered include pool grade, extent of shade and cover, mean summer water temperatures, extent of floods and siltation, and abundance of potential bottom food organisms of fishes. All features show considerable variation among streams, but the variability in numbers and volume of bottom organisms even in samples taken entirely within one bottom type in each stream was so great that reliable estimates of food production could not be made.

Seasonal estimates were made of the standing crops of fishes, in numbers and pounds per acre. Survival rates and migrational tendencies of hatchery-reared brook, brown and rainbow trouts were measured. Food habits of dominant species and spawning habits of trout were studied. Fishing intensity in the four streams was compared.

The results indicated that there was considerable seasonal variation in the size of standing crops, both of trout and of other species. Generally, streams which support large numbers of non-trout species carried few trout. In all waters, hatchery-reared fish nearly disappeared within six to eight weeks following planting, yet they contributed substantially to the early season catch. Size of the trout population was limited by different combinations of factors in each stream. Important among these were: fishing pressure, the shifting of bottom materials which results in destruction of bottom organisms and trout nests, and competition for food and space.

Two general conclusions can be drawn: (1) the success of the stocking program in certain southern Michigan streams approaches that of more northern waters of the State; (2) future stocking of these streams just prior to the opening of the season, and again later if fishing pressure continues, is justifiable.

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A CYTOLOGICAL STUDY OF CYATHODINIUM

(Publication No. 5494)

Frances Arlene Ritchey, Ph.D.
State University of Iowa, 1953

This study is based primarily on Feulgen and hematoxylin stained preparations of the ciliate Cyathodinium from the caecum of Cavia porcellus and confirms Nie's statement that both division and rejuvenescence occur in Cyathodinium piriforme and C. cunhai. In binary fission, the old ciliary apparatus is resorbed. The last stages of micronuclear mitosis seem to occur simultaneously with the appearance of two ciliary anlagen in the cytoplasm.

These anlagen migrate to a lateral position in the animal where they subsequently evaginate and form the anterior ends of the daughters. Micronuclear division and formation of the ciliary anlagen are followed by constriction of the macronucleus which contains a clear rod-like cristaloide and large granules which are extruded into the cytoplasm.

In some cases, Cyathodinium undergoes rejuvenescence unaccompanied by binary fission. In rejuvenating C. piriforme, a "quartet" of nuclei is commonly seen in which the two larger members, because of their possession of a cristaloide, are interpreted as division products of the macronucleus and the two smaller members are believed to be formed by division of the original micronucleus. The two macronuclei disintegrate, while one of the micronuclear products is transformed into the anlage of the new macronucleus and the remaining member continues to serve as a micronucleus. As in fission, the old ciliature is resorbed, but only a single anlage is formed. There is no synchronization between nuclear and cytoplasmic changes in rejuvenescence.

Early stages of micronuclear mitoses are seen in animals in which the macronucleus still appears in its normal trophic form and in which no ciliary anlage are yet seen. These organisms are believed to be in an indeterminate stage which can be followed by either fission or rejuvenescence. No evidence of meiosis or syncaryon formation was seen. Rejuvenescence is interpreted as an aborted fission.

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IN VITRO STUDIES ON OVULATORY MECHANISMS IN THE FROG, RANA PIPIENS

(Publication No. 5720)

Paul Adrian Rondell, Ph.D.
University of Michigan, 1953

It has become a commonplace that ovulation in vertebrates is regulated by pituitary hormones, but the mechanism by which the active principles produce the release of eggs is little understood. It has been suggested that the leutenizing hormone in some manner stimulates the ovary which independently causes a breakdown of the follicular wall and extrudes the egg. This investigation was undertaken in an attempt to determine some of the ovarian metabolic systems operative in the process of ovulation.

An in vitro ovulation technique was used in which fragments of Rana pipiens ovary were caused to ovulate by exposure to pituitary extract.

The hypothesis that the ovary elaborates a proteolytic enzyme which digests the follicular stalk membrane could not be validated by either of two types of experiment. Attempts were made to induce ovulation in untreated fragments by exposing them to extracts of ovaries in various stages of the ovulatory process, and measurements were made of the amino acid concentration changes associated with the process as a possible index of proteolysis.

The effects on ovulation of a variety of metabolic inhibitors were measured. Cyanide, urethane, fluoride, azide, iodo-acetate, di-nitro-phenol, ρ-chloro-mercuri-benzoic acid, di-benzyline, and sodium malonate all inhibited the process. Adenosine-triphosphate (Pabst), surprisingly, was also inhibitory. The data obtained indicate that glycolysis, the Krebs cycle and the cytochrome-cytochrome oxidase systems are essential to ovulation.

The necessity of aerobic conditions for ovulation was determined, and the effects of cyanide and methylene blue and iodo-acetate on respiration were measured manometrically. A respiratory rate differential between ovulating and non-ovulating fragments was demonstrated.

The role of the follicular musculature was investigated by the use of a group of nerve blocking agents. Pyribenzamine, hexamethonium, and atropine produced no effect on ovulation. Papaverine, a smooth muscle depressant, prevented the destruction of the stalk membrane.

It is concluded that the active pituitary principle stimulates the ovary to produce an enzymatic destruction of the follicle wall (though the proteolytic nature of the enzyme action could not be demonstrated) and that the expulsion of the egg is not dependent on contraction of muscle cells in the follicular wall, although maintenance of muscle tonus may be a necessary factor.

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THE LIFE-HISTORY OF MEGALODISCUS FERRISSIANUS N. SP. (TREMATODA: PARAMPHISTOMATIDAE)

(Publication No. 5736)

Robert Jay Smith, Ph.D.
University of Michigan, 1953

Ancylid snails, Ferrissia novangliae (Walker) were included in a snail survey from three areas near Ann Arbor, Michigan. Six types of trematode cercariae were found to be emerging from these fresh-water limpets. These included two species of strigeids, a spirorchid, an echinostome, a xiphidiocercaria and one species of amphistome. Out of approximately 10,000 ancylid snails collected from one area, there was an amphistome infection as high as from 40 to 60 percent during the summer and autumn months. It was concluded that Ferrissia novangliae was the natural first intermediate host for the amphistome parasite involved.

The adult generation was found in the recta of frogs Rana clamitans, Rana pipiens and Rana catesbeiana. The name Megalodiscus ferrissianus n. sp. is proposed for this parasite. It can be separated from other rectal amphistomes in frogs on the basis

of differences in the life-history, such as the utilization of an ancylid snail as the natural first intermediate host and the time required for development in the snail. Other differences include smaller size of the cercaria and reproductive organs, medial loopings of the main excretory ducts and a greater number of excretory concretions within these ducts. The redial generations differ from other closely allied species in lacking locomotor appendages and having a much smaller gut. Certain minor differences could be noted in the adult generation.

In no case was Megalodiscus ferrissianus found to be infecting any snail but Ferrissia novangliae, although many other species were collected from this same area. Attempts to infect other snails in the laboratory were negative. Snails belonging to the family Ancylidae are world-wide in distribution. However, as far as the author is aware, no trematode life-history has been reported which involves this type of snail. Due to the great abundance of these minute fresh-water limpets and the comparative ease with which they could be raised in the laboratory, experiments were carried out to determine the life-history of Megalodiscus ferrissianus.

Eggs of the mature worms pass out with the feces. The miracidium hatches soon after coming in contact with water and penetrates the mantle or foot of Ferrissia novangliae. At time of hatching the miracidium contains a single partially developed mother redia. The mother sporocyst remains intact as a protective covering until the mother redia is fully developed. Only one to four mother sporocysts may be present in a single snail. The first-generation redia ruptures out of the mother sporocyst in six to seven days after penetration of the miracidium. In 13 to 15 days the mother redia starts liberating second-generation rediae. The mother redia disintegrates and disappears between the 23rd and 27th day, after five to seven daughter rediae have been liberated.

Immature cercariae are liberated into the tissues of the snail usually around the 25th to 30th day. Cercariae having completed their development in the snail tissues, begin to emerge from seven to ten days after their liberation from the daughter redia. About seven to ten cercariae emerge each day for a period of eight to ten days. The snail then appears to lose the infection and may become reinfected.

Encystment of cercariae takes place on stratum corneum of tadpoles and frogs. Metacercariae are infective immediately and may remain viable and infective for three months. Metacercariae are taken in passively by frogs when the stratum corneum is devoured. Adult worms come to maturity in the rectum within two to three months. Young frogs appear to be the most heavily infected. In most cases when two or three mature worms are present, the remaining worms are immature.

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STRUCTURAL CHANGES IN THE EARLY CHICK BLASTODERM INDUCED BY INCREASED PARTIAL PRESSURE OF OXYGEN

(Publication No. 5628)

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University of Pennsylvania, 1953

Supervisor: Olin E. Nelson

The specific purposes of this study were:

(1) to determine the effects of an increased partial pressure of oxygen on the gastrulation processes and early morphogenesis of the chick embryo;

(2) to observe changes in the nuclei of the cells as a result of exposure to increased oxygen tension; and

(3) to note the effects on the survival of the embryo in relation to different durations of oxygen exposure applied at various stages of the gastrulation process.

Hens' eggs were exposed for various intervals of time to a gaseous environment composed of 3 atmospheres of oxygen added to 1 atmosphere of air in a pressure chamber. Two methods of exposure were utilized, as follows;

(1) Continuous exposure for varying lengths of time from the beginning of incubation, and

(2) Exposure for different durations following previous incubational periods which varied in length of time.

Eggs experiencing exposure from the beginning of incubation demonstrated the following;

(a) exposure for the first 8 hours of incubation produced a retardation in development;

(b) exposure for the first 9 hours produced an inhibition of embryonic development but not of the extra-embryonic membranes;

(c) exposure for the first 10 to 14 hours resulted in an inhibition of the blastodermic organization but not of mitosis;

(d) exposure for 14 or more hours effected a complete inhibition of blastodermic organization and of mitosis but nuclear enlargement occurred.

Eggs submitted to various exposure periods following previous periods of incubation varying in length of time demonstrated different degrees of inhibition depending on the duration of treatment and also on the stage of gastrulation at which the treatment was applied. These results may be summarized as follows;

(a) Exposure of the developing egg during the time previous to 10th or 11th hour of incubation, i.e. during early to middle streak formation, elicits retarded but not abnormal development.

(b) When the exposure period extends beyond the mid-streak condition, i.e. during the time when the definitive streak is being formed, various degrees of abnormal development occur.

(c) When the oxygen exposure is applied after the definitive primitive streak has definitely formed and during the later phases of gastrulation culminating in the "head process" stage, completely disorganized development ensues.

These results suggest that the organizing influences which govern the earlier phases of primitive streak formation and gastrulation are less affected by the higher tensions of oxygen exposure used in the experiment than are the influences which govern the later phases of primitive streak formation and gastrulation. The experiments further demonstrate that different areas of the developing blastoderm and embryo possess different sensitivities to the oxygen exposure.

It is probable that the oxygen exposure influences the underlying mechanisms which effect the morphological emergence of structural organization. When the oxygen exposure is made prior to the time when these mechanisms are established, development tends to be normal, but when the exposure is made during the period when the underlying physiological mechanisms are formed, development becomes abnormal and disorganized.

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DISSERTATION ABSTRACTS

Volume XIII, No. 6

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